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Kim et al.

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(54) **LAUNDRY HANDLING APPARATUS**

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D06F 58/22 (2006.01)
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CPC ***D06F 58/22*** (2013.01); ***D06F 25/00*** (2013.01); *D06F 58/24* (2013.01)

(58) **Field of Classification Search**
CPC D06F 58/22; D06F 58/00; F26B 21/03; F26B 25/007
(Continued)

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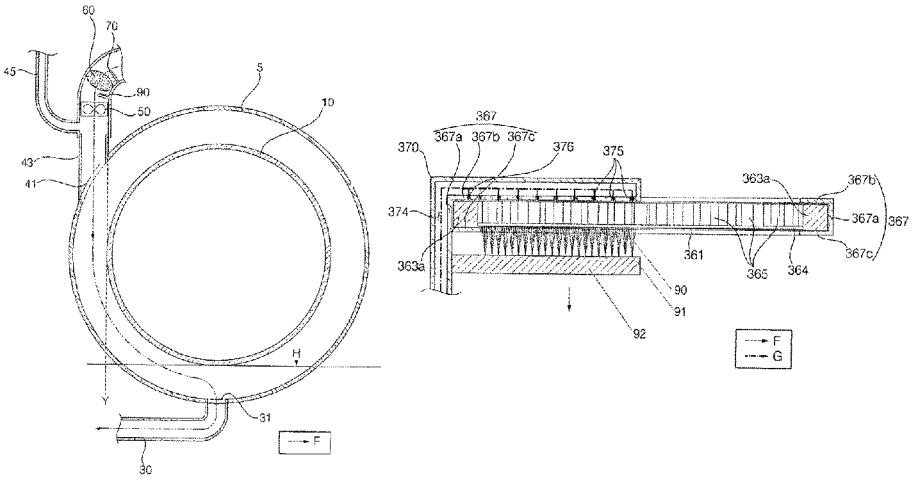
(57) **ABSTRACT**

The present invention relates to a laundry handling apparatus provided with a washable filter in an air circulation passage for drying laundry. The laundry handling apparatus according to the present invention comprises: a cabinet, an outer tub disposed inside the cabinet, an inner tub rotatably disposed inside the outer tub, a circulation passage for guiding at least some of the air inside the outer tub to flow out of the outer tub and be resupplied to the outer tub, a fan disposed in the circulation passage so as to move the air, and a filter unit for filtering foreign substances. The filter unit comprises a filter net, which is disposed in the circulation passage so as to collect the foreign substances contained in the moving air, and a filter frame for supporting the filter net. The laundry handing apparatus comprises: multiple nozzles for spraying wash water onto a partial area of the filter net, a nozzle disposition unit, which is disposed in a position spaced apart from the filter net and has the multiple nozzles arranged therein, a nozzle water supply hose, which is connected to the nozzle disposition unit so as to supply the wash water, which is sprayed by the multiple nozzles, and a filter driving unit for allowing the filter unit and the nozzle
(Continued)



disposition unit to move relative to one another so that the wash water is sprayed onto the entire area of the filter net.

15 Claims, 15 Drawing Sheets

(51) **Int. Cl.**
D06F 25/00 (2006.01)
D06F 58/24 (2006.01)

(58) **Field of Classification Search**
USPC 34/292, 300, 480, 82, 261
See application file for complete search history.

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Fig. 1

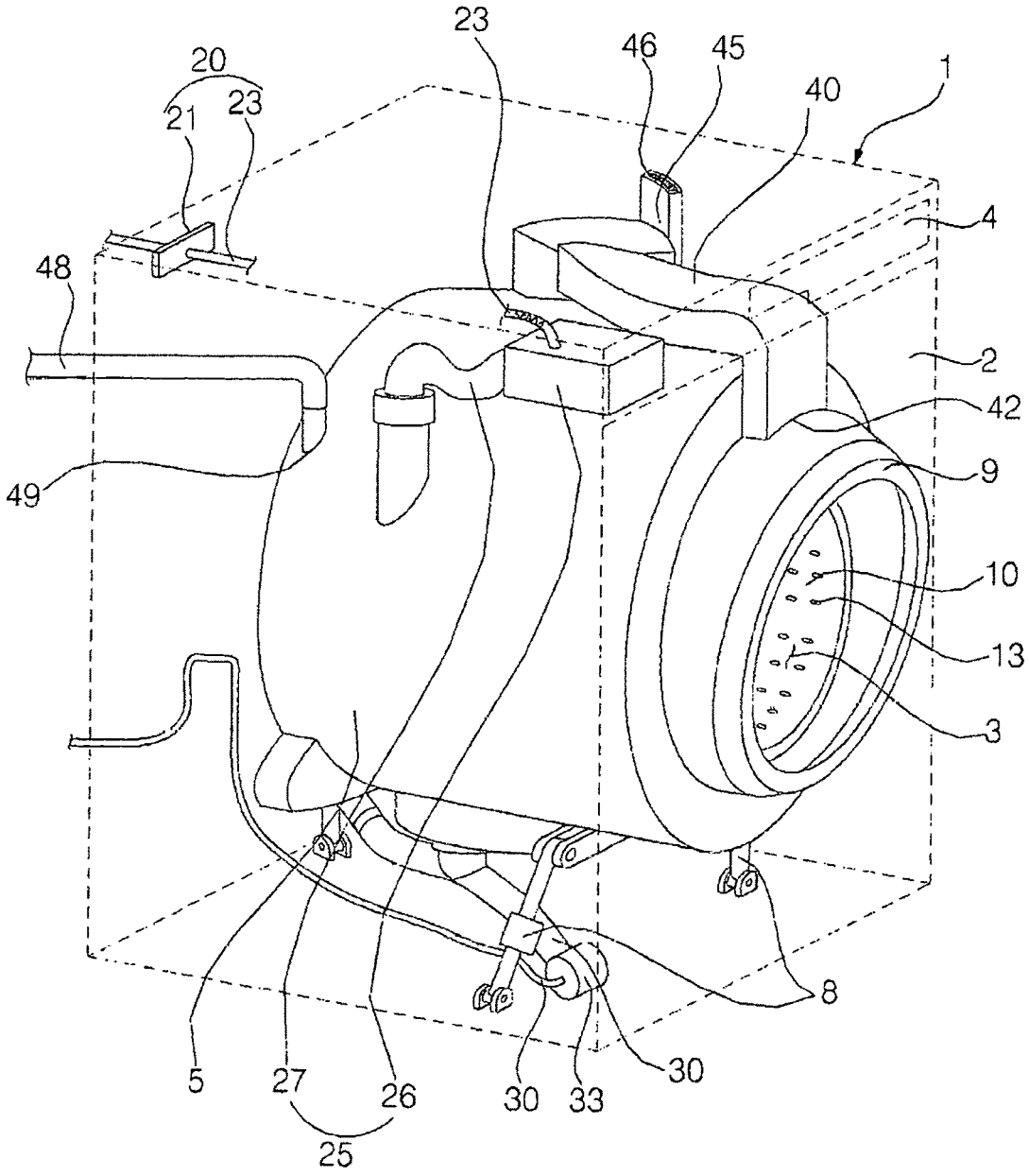


Fig. 2

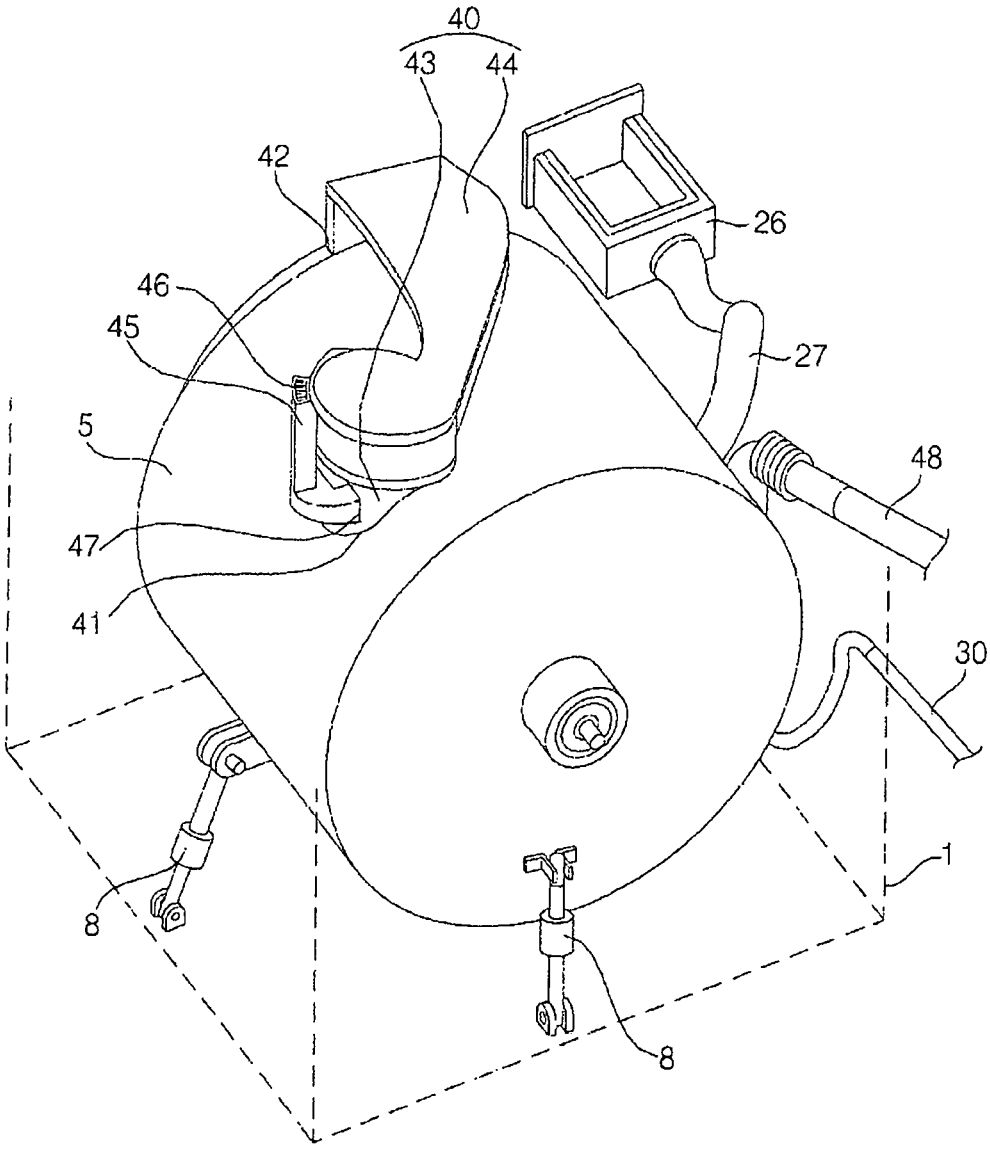


Fig. 3

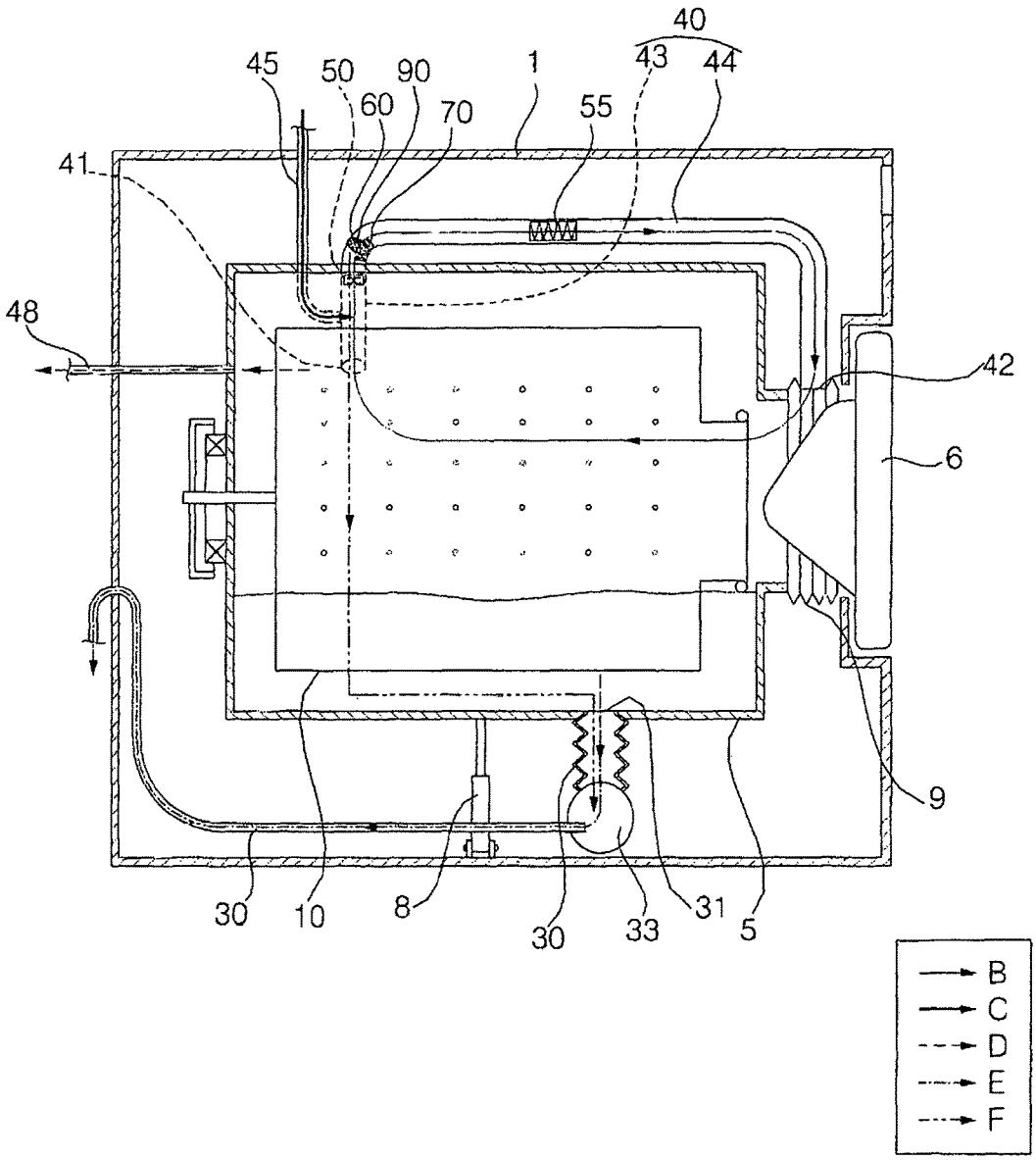


Fig. 4

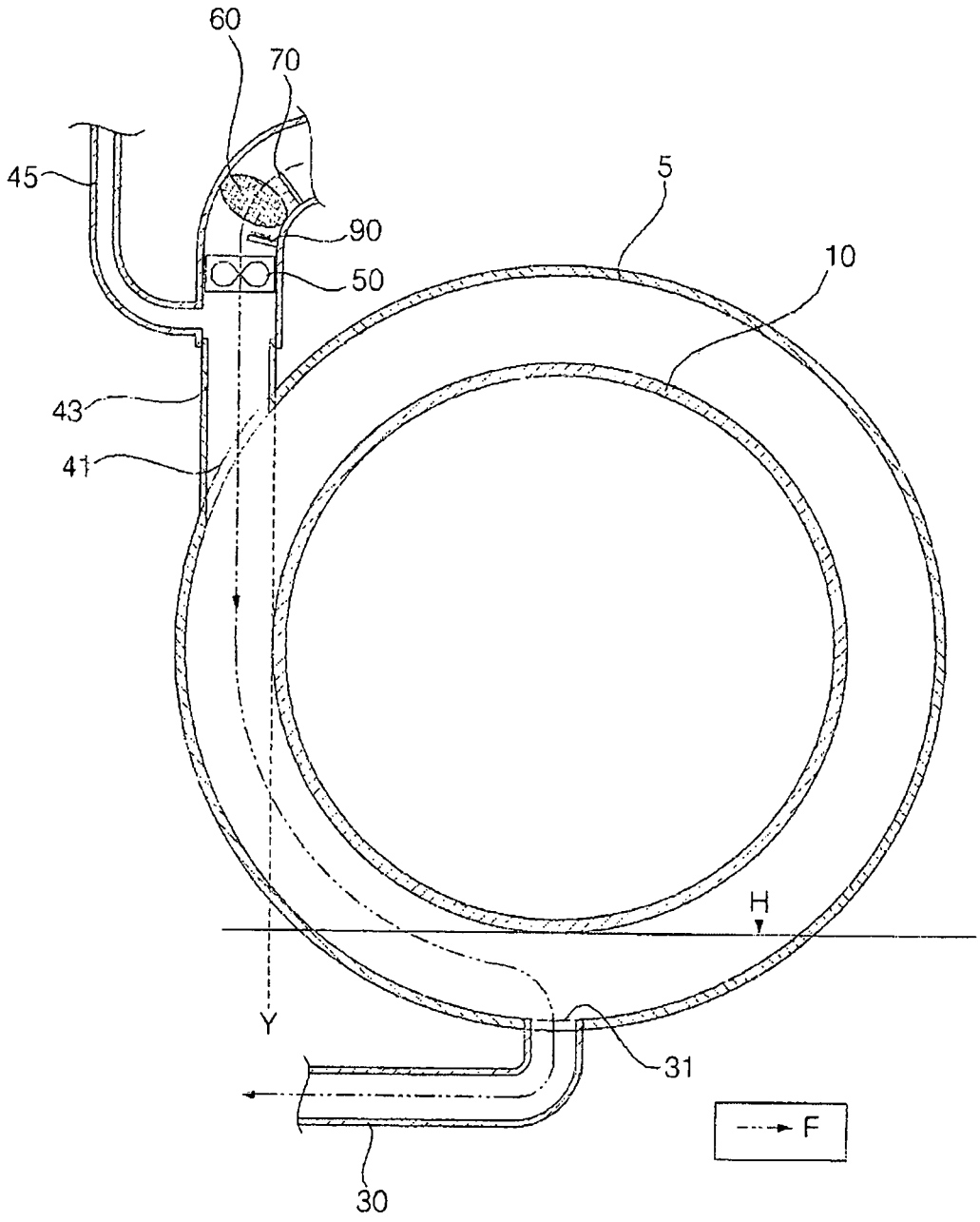


Fig. 5

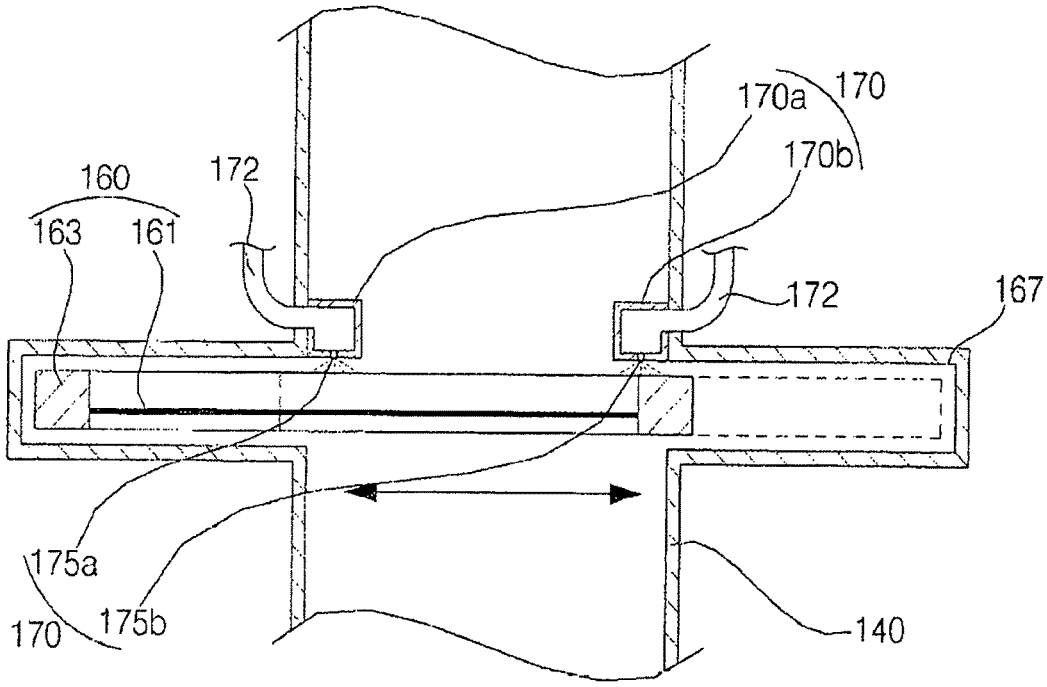


Fig. 6

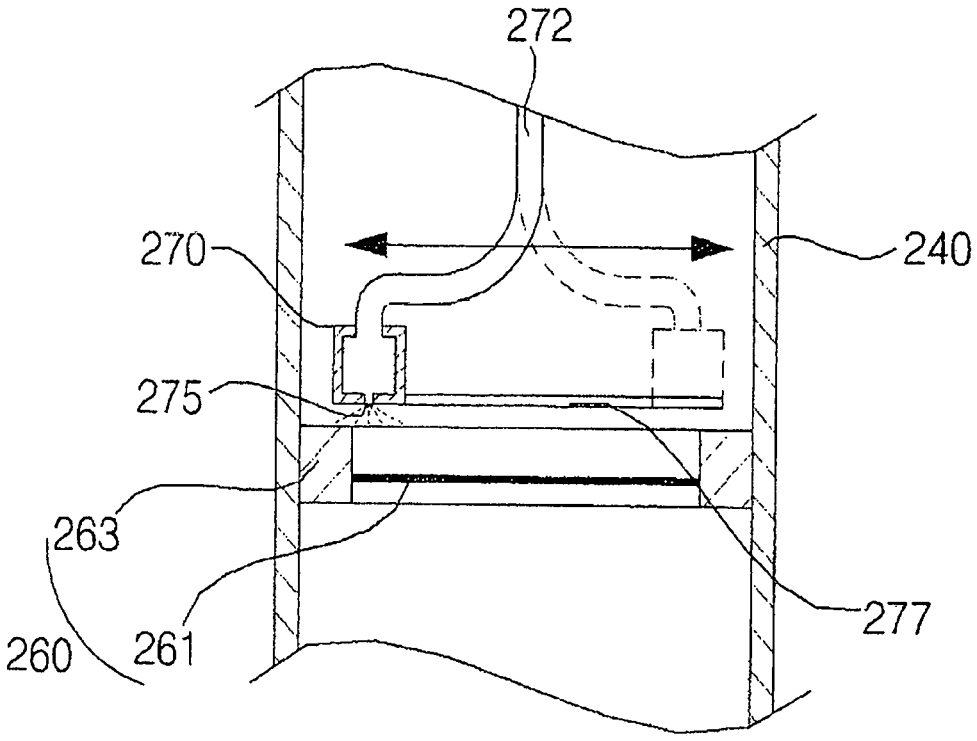


Fig. 7

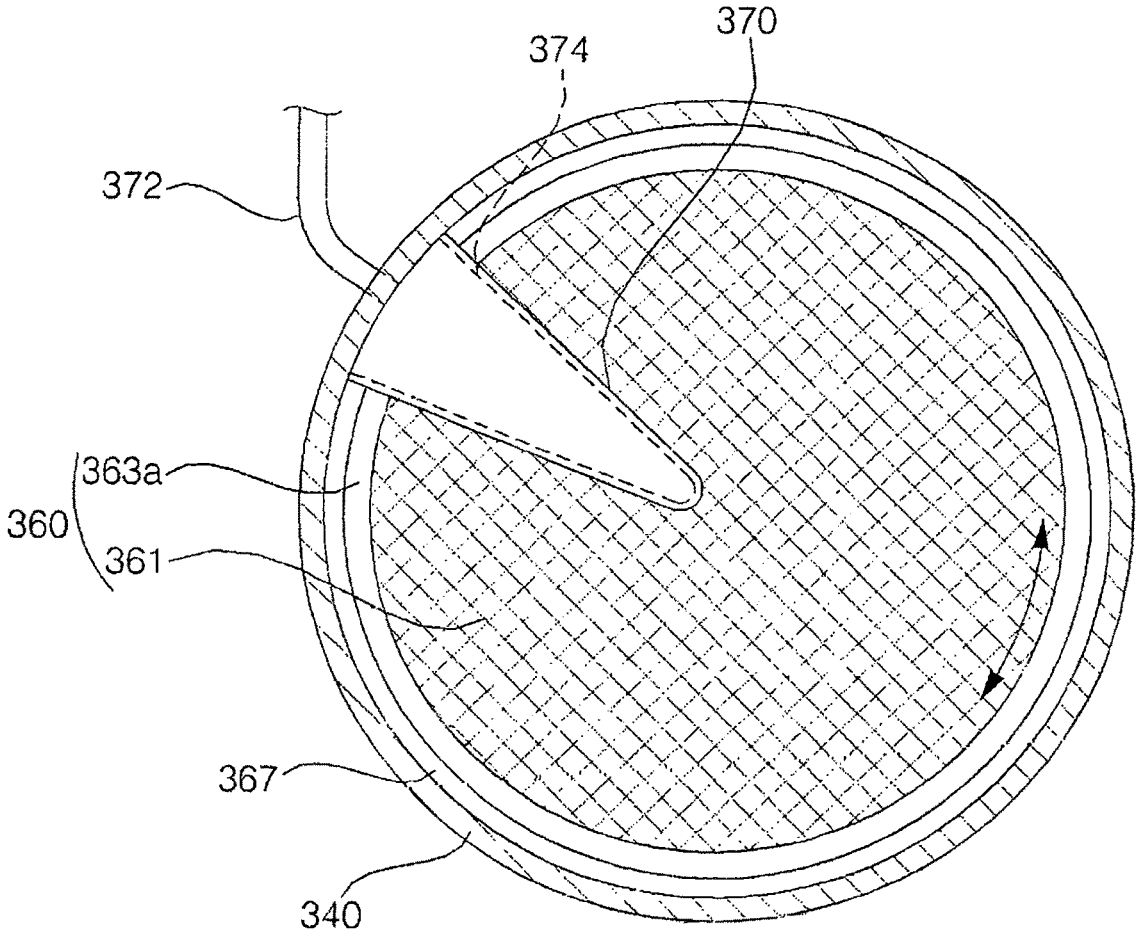


Fig. 8

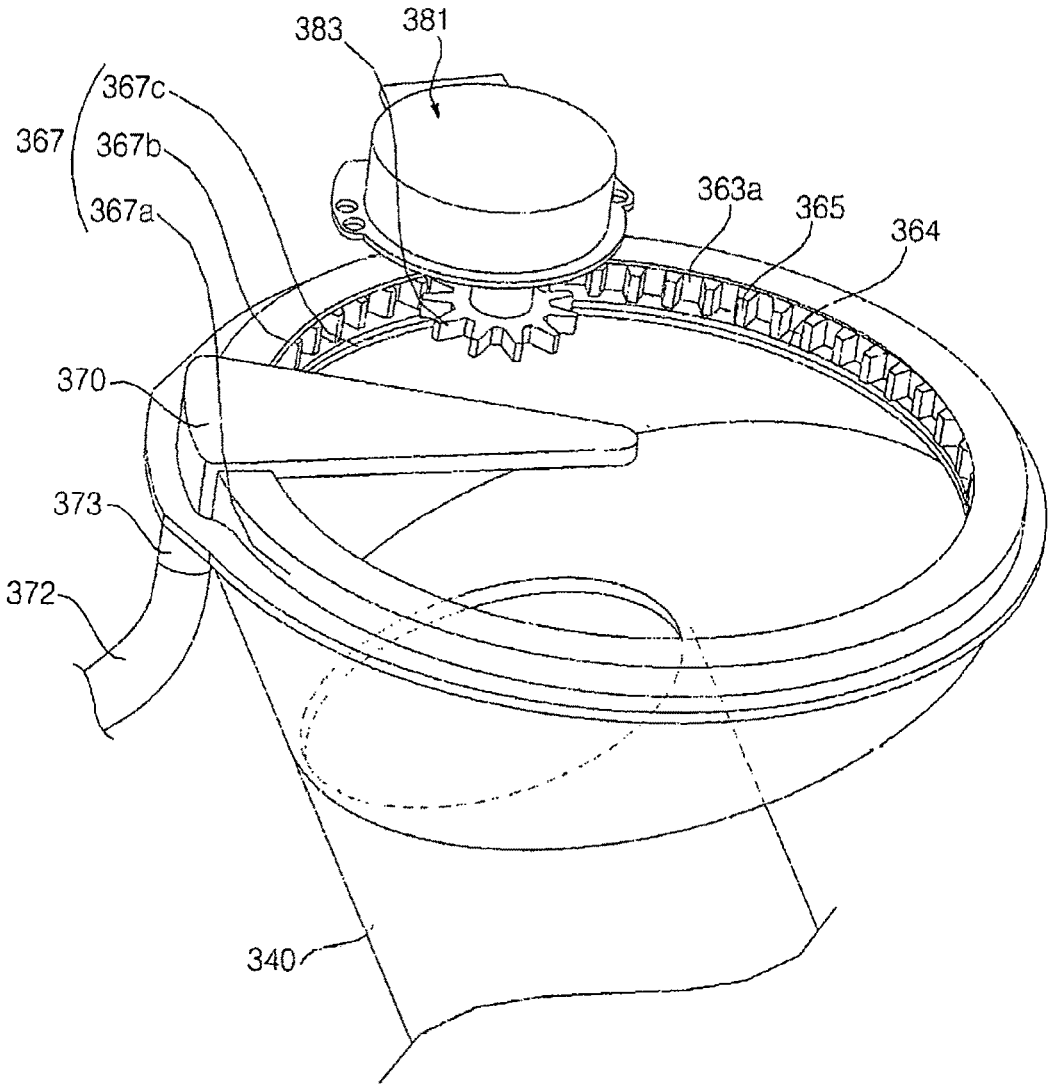
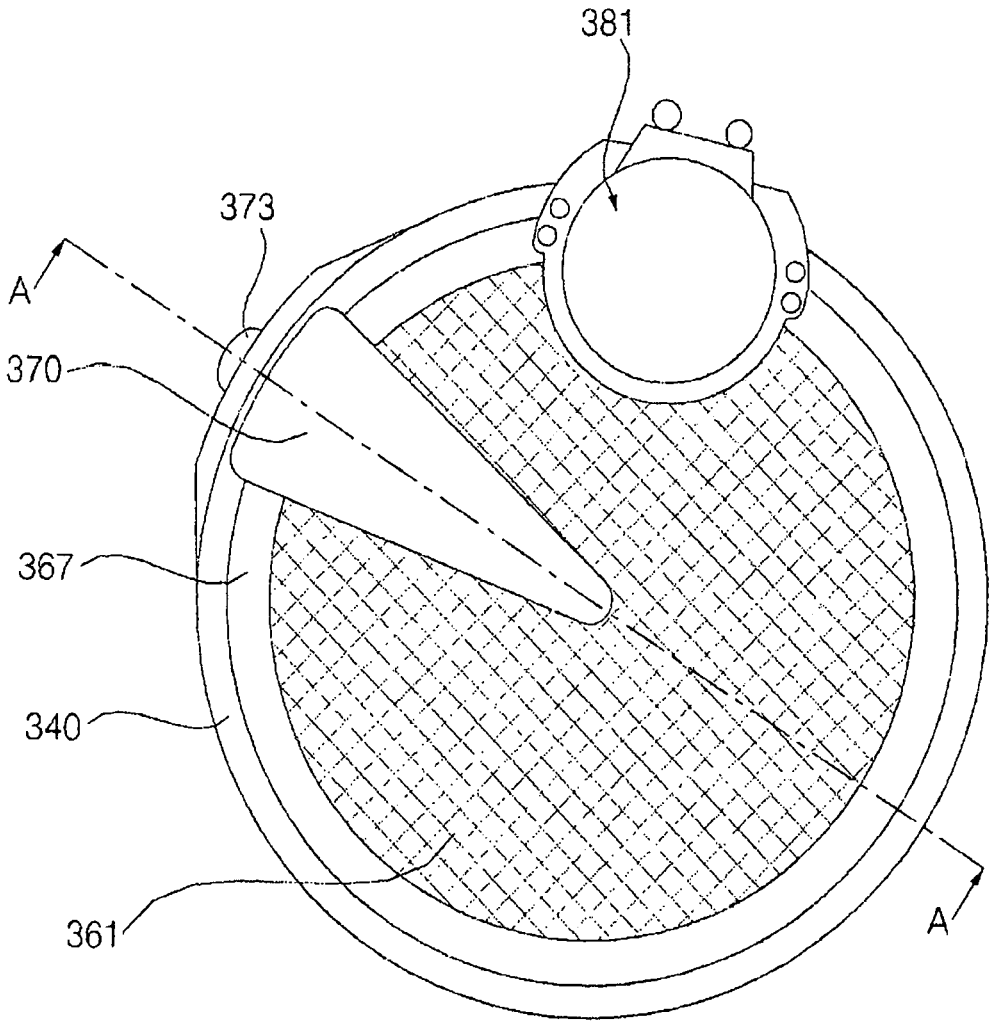
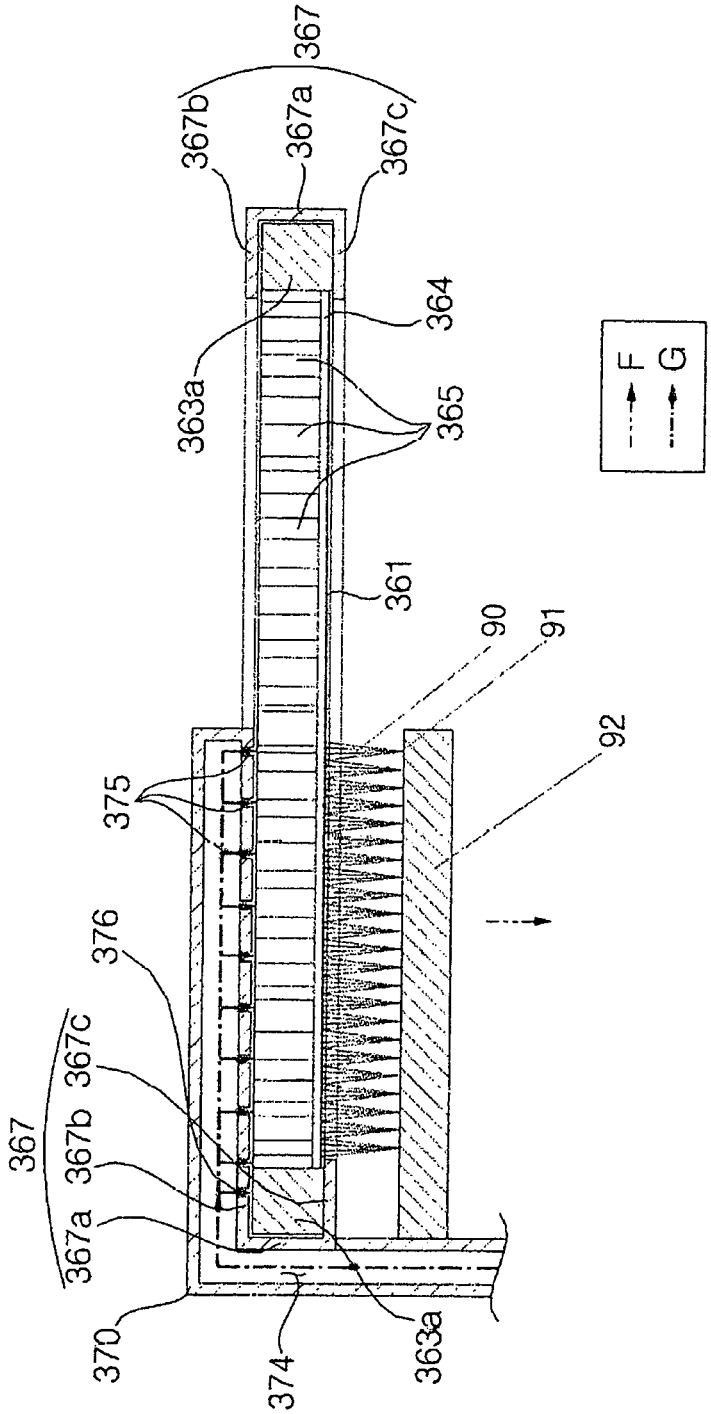


Fig. 9




367
367b
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367c
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363a
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Fig. 10

Fig. 11

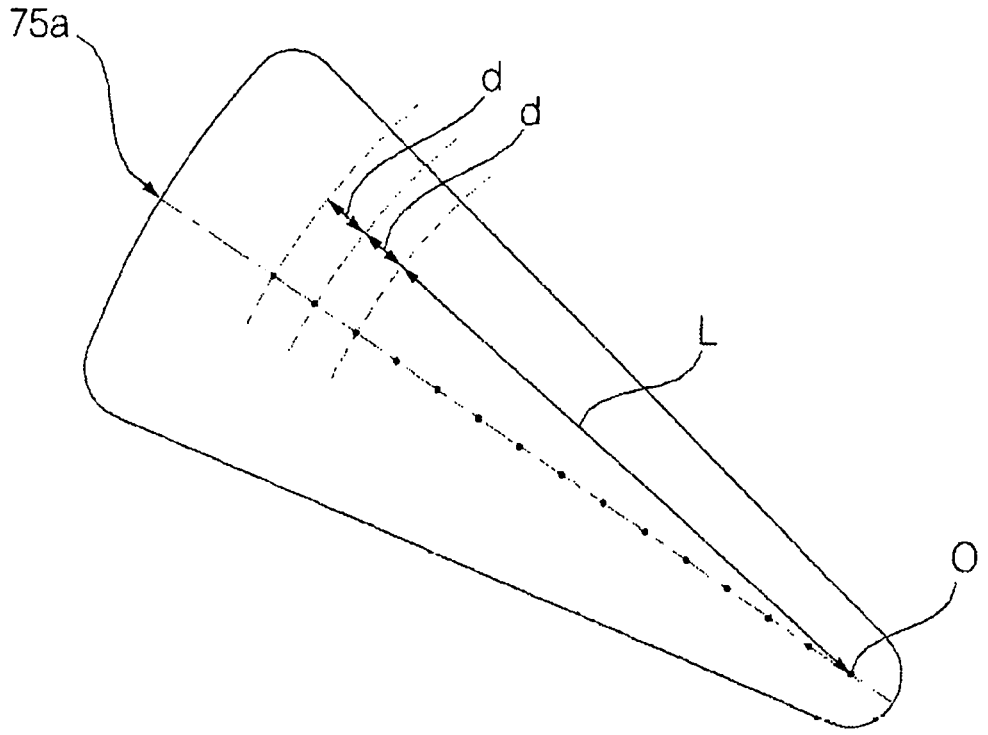


Fig. 12

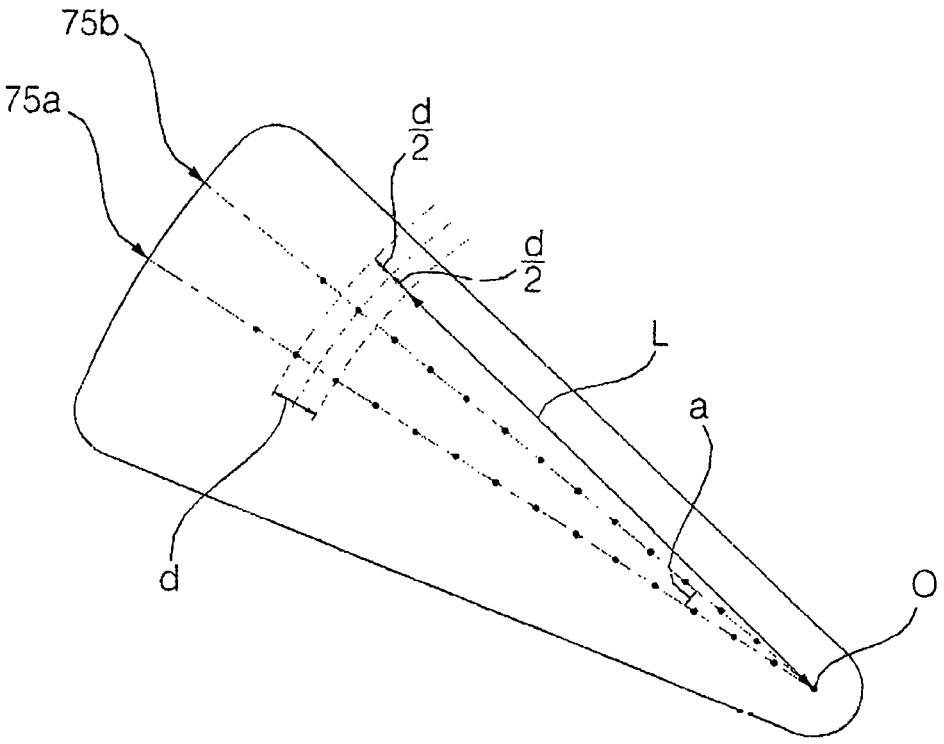


Fig. 13

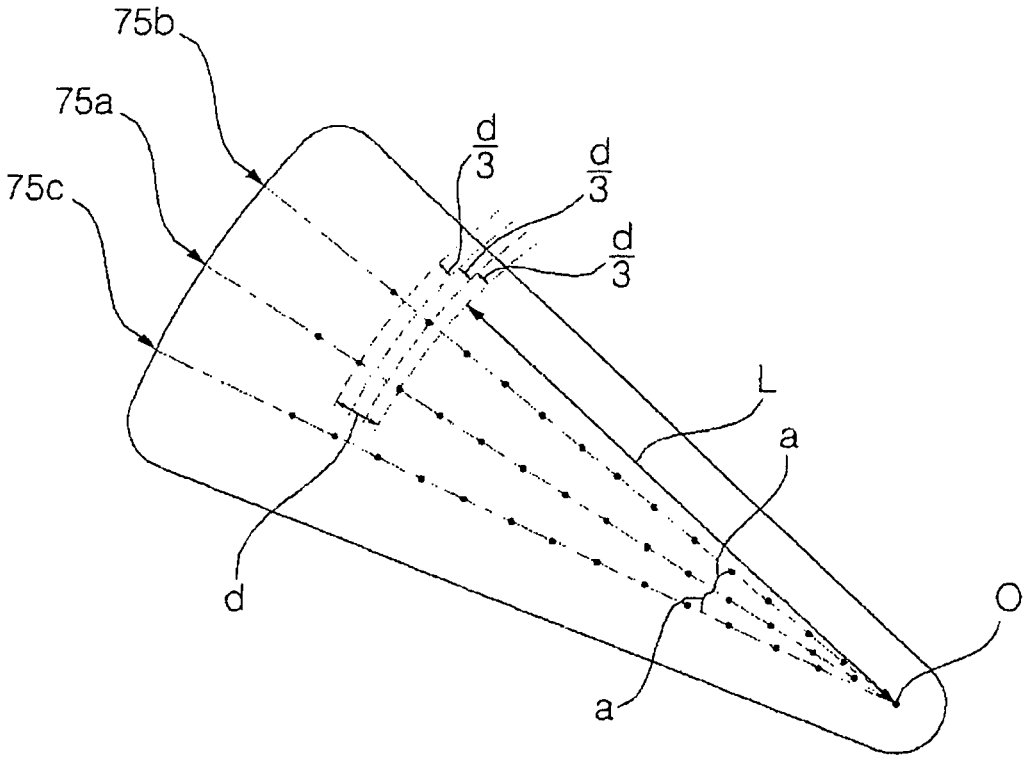


Fig. 14

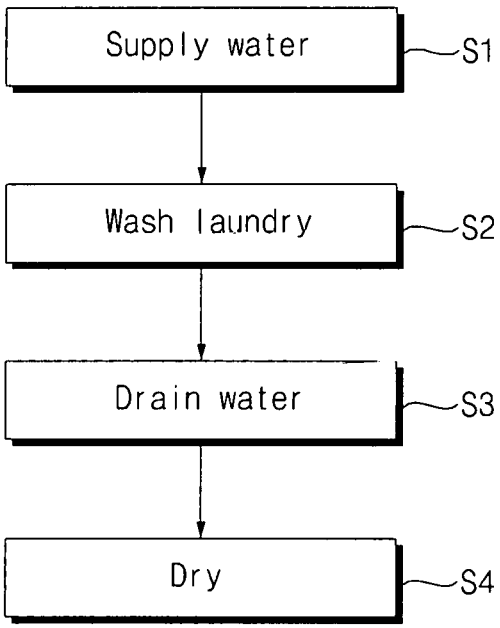
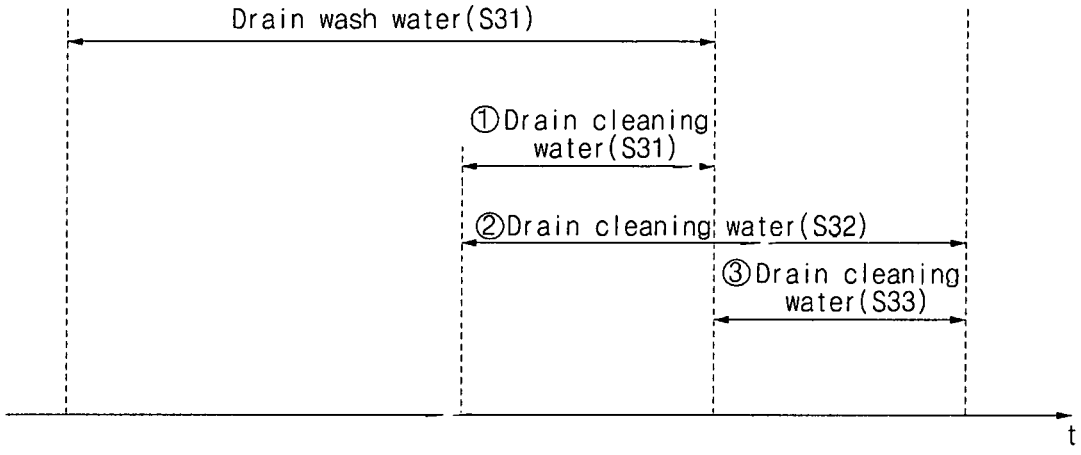


Fig. 15


Drain wash water(S31)
①Drain cleaning water(S31)
②Drain cleaning water(S32)
③Drain cleaning water(S33)
t

LAUNDRY HANDLING APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a National Stage application under 35 U.S.C. § 371 of International Application No. PCT/KR2016/009064, filed Aug. 18, 2016, which claims the benefit of Korean Application No. 10-2015-0116218, filed on Aug. 18, 2015. The disclosures of the prior applications are incorporated by reference in their entirety.

TECHNICAL FIELD

The present invention relates to a laundry handling apparatus capable of drying laundry, and more particularly to a laundry handling apparatus provided with a washable filter in an air circulation passage for drying laundry.

BACKGROUND ART

In general, a laundry treatment apparatus includes a cabinet, an outer tub disposed inside the cabinet, and an inner tub rotatably disposed inside the outer tub.

A laundry treatment apparatus capable of drying laundry supplies heated air (hot wind) to laundry. A dry system is classified into an exhaust type dry system for exhausting air to the outside, a circulation type dry system for adjusting a temperature and humidity of the air to resupply the adjusted air to laundry, and a hybrid type dry system for exhausting some of the air and resupplying remaining air to laundry according to how to treat air having increased humidity by making contact with the laundry.

A laundry treatment apparatus including the circulation type dry system or the hybrid type dry system includes a circulation passage for guiding at least some of air inside the outer tub to flow out of the outer tub and be resupplied to the outer tub.

Foreign substances separated from laundry are included in air moving through the circulation passage. In particular, if the inner tub is rotated during a drying stroke, friction occurs in the laundry so that an amount of the foreign substances is further increased. In this case, the foreign substances adhere to a temperature and humidity controller included in the circulation passage so that failure of the temperature and humidity controller may occur or the efficiency may be deteriorated, and foreign substances in air resupplied into the outer tub may adhere to the laundry.

In order to solve the above problems, the related art provides a filter disposed on the circulation passage to filter out the foreign substances. The filter includes a filter net and the filter net functions to collect foreign substances. The relater art includes a nozzle for spraying cleaning water to automatically remove the foreign substances collected in the filter net.

DISCLOSURE

Technical Problem

In the related art, if the wash water passes through the filter net by directly spraying the wash water to the filter net, it is easy to remove foreign substances collected in a part of the filer net colliding with the wash water. However, since the wash water passes through the filter net, it difficult to remove the foreign substances collected in a remaining part of the filter net. A first objective is aimed at solving the above problem.

In the related art, if the wash water flows through the filter net by spraying the wash water around the filter net, it is easy to supply the wash water to a wide area of the filter net. Since a flow rate of flowing wash water is lower than a flow rate of the sprayed wash water, although the wash water is supplied, foreign substances collected in the filter net may not be easily removed. A second objective is aimed at solving the above problem.

A third objective is to minimize the number of nozzles while directly spraying wash water to the entire area of the filter net.

In the related art, the nozzle and the filter are fixed. In this case, it is difficult to uniformly supply the sprayed wash water to the entire area of the filter net due to a deviation of a spray angle of the nozzle and a deviation of water pressure. A fourth objective is aimed at solving the above problem.

In the related art, when the foreign substances adhere to the filter net, although the wash water is sprayed to the filter net, the foreign substances are not easily removed. A fifth objective is aimed at solving the above problem.

A sixth objective is aimed at easily draining the wash water sprayed to the filter net and the removed foreign substances.

The above information disclosed in this background section is only for enhancement of understanding of the background of the invention and therefore it may contain information that does not form the prior art that is already known in this country to a person of ordinary skill in the art.

Technical Solution

In order to achieve the above objectives, a laundry handling apparatus according to the present invention includes: a cabinet; an outer tub disposed inside the cabinet; an inner tub rotatably disposed inside the outer tub; a circulation passage for guiding at least some of the air inside the outer tub to flow out of the outer tub and be resupplied to the outer tub, a fan disposed in the circulation passage so as to move the air; a filter unit for filtering foreign substances.

The filter unit includes a filter net, which is disposed in the circulation passage so as to collect the foreign substances contained in the moving air, and a filter frame for supporting the filter net.

The laundry handling apparatus includes multiple nozzles for spraying wash water onto a partial area of the filter net; a nozzle disposition unit, which is disposed in a position spaced apart from the filter net and has the multiple nozzles arranged therein; a nozzle water supply hose, which is connected to the nozzle disposition unit so as to supply the wash water, which is sprayed by the multiple nozzles; and a filter driving unit for allowing the filter unit and the nozzle disposition unit to move relative to one another so that the wash water is sprayed onto the entire area of the filter net.

The plurality of nozzles is disposed in a direction to traverse a track of the relative motion in order to spray the wash water to the entire area of the filter net according to the relative motion.

In order to guide a flow direction of the wash water capable of easily washing the foreign substances, the nozzle disposition unit may be disposed at a lower side with respect to the filter net.

In order to guide a flow direction of the wash water capable of easily washing the foreign substances and to easily drain the used wash water and foreign substances

included in the wash water, the present invention presents disposition relationship between the filter net, the nozzle disposition unit, and the plurality of nozzles on the circulation passage. The circulation passage may include a section which upwardly extends from the upper side to the lower side. In this case, the filter net is disposed to laterally traverse the upwardly extending section of the circulation passage, the nozzle disposition unit is disposed at a top side of the filter net, and the plurality of nozzles is provided at a bottom surface of the nozzle disposition unit and sprays the wash water in a downward direction.

The present invention presents a first embodiment to a third embodiment capable of realizing the relative motion. The nozzle disposition unit is fixed and the filter driving unit may move the filter unit to implement the relative motion. Further, the filter frame may include an edge frame configured to support the filter net along a peripheral of the edge frame. In this case, the filter driving unit may allow the edge frame to perform a rotation motion so that the relative motion may be implemented.

In order to easily remove foreign substances adhering to the filter net, the laundry handling apparatus may include a brush disposed to make contact with the filter net in a direction to traverse a motion track of the filter net. The brush may be disposed at a lower side with respect to the filter net.

Moreover, in order to remove foreign substances adhering to the bush, the nozzle disposition unit may be disposed at a lower side with respect to the filter net. In addition, the brush may be disposed to make contact with the filter net along a collision region of the wash water sprayed from the plurality of nozzles with the filter net.

In order to uniformly spray wash water to the entire area of the filter net, the present invention presents an arrangement and relationship of the plurality of nozzles. The nozzle disposition unit may protrude in a direction of a rotation axis of the rotation motion from a part of the periphery of the edge frame. In this case, the plurality of nozzles may include a first nozzle group configured by nozzles spaced apart from each other in one radial direction of the edge frame on the nozzle disposition unit.

Furthermore, the nozzles of the first nozzle group are spaced apart from each other by a predetermined distance d. In this case, a value obtained by dividing the predetermined distance d is defined by n as an equal value d/n, and distances between the nozzles of the first nozzle group and the rotation axis O are defined as reference values L, respectively. In this case, the plurality of nozzles comprises a n-th nozzle group configured by nozzles arranged at a position distant from the rotation axis O by a distance L+(n−1)*d/n obtained by summing respective reference values L and (n−1) multiple of the equal value d/n, in different radial directions of the edge frame forming an angle a with one radial direction on the nozzle disposition unit.

In order to allow the filter driving unit to efficiently and durably operate, to prevent foreign substances from being easily collected in the filter driving unit, and to remove the foreign substances collected in the filter driving unit, the present invention presents structures and arrangement relationships of the filter net, the edge frame, the driven gear, the work gear (driven gear), and the motor. The edge frame may include a driven gear protruding in a direction of a rotation axis along a periphery of the edge frame. In this case, the filter driving unit includes: a worm gear meshing with the driven gear; and a motor configured to rotate the worm gear.

Moreover, the nozzle disposition unit may be disposed at a direction of a disposition surface of the driven gear of directions of both surfaces of the filter net. In this case, the nozzle disposition unit includes a nozzle configured to spray wash water to the driven gear.

Further, the driving gear and the worm gear may be disposed at a lower side with respect to the filter net.

In order to operate the present invention although foreign substances are inserted into the filter driving unit and to efficiently remove the foreign substances of the filter net, the present invention presents a function of the motor. A rotation direction of the motor **382** may be reversely changed if resistance greater than a predetermined reference occurs upon rotation of the motor. In addition, the filter driving unit and the driven gear may be provided so that the edge frame is rotated at speed in the range of 1 rpm to 6 rpm.

The details of other embodiments are contained in the detailed description and accompanying drawings.

Advantageous Effects

First, the present invention may uniformly clean the entire area of the filter net while easily separating the foreign substances collected in the filter net by directly spraying wash water to the filter net.

Second, since the number of nozzles may be reduced while uniformly washing the entire area of the filter net. Accordingly, the whole area of the filter net may be washed by strong shock of the wash water.

Third, since the number of nozzles may be reduced, although the nozzles are disposed right in front of the filter net, a part blocking the circulation passage is not large. Accordingly, the foreign substances collected in the filter net are easily separated by spraying the wash water in close proximity to the filter net so that pipeline resistance of the circulation passage is not almost increased.

Fourth, a cleaning performance of the nozzle may be increased by intensively spraying a constant amount of wash water and spraying the wash water to other areas with a time difference. In this way, the wash performance is significantly increased as compared with a case of simultaneously spraying the wash water to the entire area of the filter net.

Fifth, since the nozzle may be disposed right in front of the filter net, although there is a difference in water pressure or an error range of a product, a range of a preset part to spray wash water to the filter net does not significantly exceed a reference range. That is, the accuracy with respect to a spray range of the wash water is improved.

Sixth, foreign substances adhering to the filter net not to be easily separated by the wash water may be easily removed by using the brush.

Seventh, the sprayed wash water and the removed foreign substances may be easily drained through arrangement of the circulation passage, the filter unit, and the plurality of nozzles.

Eighth, the filter driving unit is efficiently and durably operated, and foreign substances are not easily collected in the filter driving unit. Even if foreign substances are collected in the filter driving unit, the collected foreign substances may be easily removed.

Ninth, when the filter driving unit receives resistance by the foreign substances inserted due to the relative motion, the present may have continuously a normal function by changing the relative motion in a reverse direction and the inserted foreign substances may be separated.

Effects of the present invention may not be limited to the above and other objects and other objects which are not

described may be clearly comprehended to those of skill in the art to which the embodiment pertains through the following description.

DESCRIPTION OF DRAWINGS

FIG. **1** is a perspective view illustrating an example of an internal configuration of a cabinet **1** in a laundry handling apparatus according to an embodiment of the present invention.

FIG. **2** is a perspective view illustrating the laundry treatment apparatus shown in FIG. **1** when the laundry handling apparatus is viewed at another angle.

FIG. **3** is a conceptual section view illustrating a flow direction of air and water on a circulation passage **40**, a suction passage **45**, an exhaust passage **48**, and a water drain passage **30** while vertically cutting the laundry handling apparatus in forward and reward directions.

FIG. **4** is a conceptual section view illustrating a flow direction of air and water on a circulation passage **40**, a suction passage **45**, an exhaust passage **48**, and a water drain passage **30** while vertically cutting the laundry handling apparatus in left and right directions.

FIG. **5** is a conceptual section view illustrating a first embodiment of a relative motion where a nozzle disposition part **170** is fixed and a filer unit **160** performs a linear reciprocating motion.

FIG. **6** is a conceptual section view illustrating a second embodiment of a relative motion whew a filer unit **160** is fixed and a nozzle disposition part **270** performs a linear reciprocating motion.

FIG. **7** is a conceptual section view illustrating a third embodiment of a relative motion where a nozzle disposition part **370** is fixed and a filer unit **360** performs a rotational motion.

FIG. **8** is a perspective view illustrating a filer unit **360** omitting a filter net, a nozzle disposition part **370**, and a filter driving unit **380** according to the third embodiment.

FIG. **9** is an elevation view illustrating the filer unit **360**, the nozzle disposition part **370**, and the filter driving unit **380** according to the third embodiment when viewed from the top.

FIG. **10** is a sectional view illustrating the filer unit **360** and the nozzle disposition part **370** taken along line A-A' of FIG. **9** by vertically cutting the filer unit **360** and the nozzle disposition part **370**.

FIG. **11** is a rear view illustrating a nozzle disposition part **370** which shows an arrangement example of a plurality of nozzles **375** according to a fifth embodiment.

FIG. **12** is a rear view illustrating a nozzle disposition part **370** which shows an arrangement example of a plurality of nozzles **375** according to a sixth embodiment.

FIG. **13** is a rear view illustrating a nozzle disposition part **370** which shows an arrangement example of a plurality of nozzles **375** according to a seventh embodiment.

FIG. **14** is a flowchart illustrating a method for controlling a laundry treatment apparatus according to an embodiment of the present invention.

FIG. **15** is a time axis (t) sequence diagram illustrating a detailed stroke start and end time points of a water drain step S3 shown in FIG. **14**.

MODE FOR INVENTION

The advantages, the features, and schemes of achieving the advantages and features of the disclosure will be apparently comprehended by those skilled in the art based on the embodiments, which are described later in detail, together with accompanying drawings. However, the present invention is not limited to following disclosed embodiments and various embodiments may be realized. Present embodiments are provided to complete the disclosure of the present invention and to completely indicate the scope of the present invention to those of ordinary skill in the art. The present invention is defined by a scope of claims. The same reference numeral in the specification refers to the same constituent element.

A laundry treatment apparatus according to the present invention may be a washing machine, a dryer, and the like. Hereinafter, a laundry treatment apparatus according to the present invention is described to limit a front loading type washing machine with reference to FIG. **1** to FIG. **14** as an example. Although the washing machine may be a washing machine with a dry function including a circulation type dry system or a hybrid dry system, a washing machine including the hybrid dry system is restrictively described below.

FIG. **1** is a perspective view illustrating an example of an internal configuration of a cabinet **1** in a laundry treatment apparatus according to an embodiment of the present invention. FIG. **2** is a perspective view illustrating the laundry treatment apparatus shown in FIG. **1** when the laundry treatment apparatus is viewed at another angle. FIG. **3** is a conceptual section view illustrating a flow direction of air and water on a circulation passage **40**, a suction passage **45**, an exhaust passage **48**, and a water drain passage **30** while vertically cutting the laundry treatment apparatus in forward and reward directions. FIG. **4** is a conceptual section view illustrating a flow direction of air and water on a circulation passage **40**, a suction passage **45**, an exhaust passage **48**, and a water drain passage **30** while vertically cutting the laundry treatment apparatus in left and right directions.

The washing machine includes a cabinet **1** forming an outer appearance. The washing machine includes an outer tub **5** disposed inside the cabinet **1** to store wash water, and an inner tub **10** rotatably disposed inside the outer tub **5** and stores laundry.

Further, the washing machine includes a water supply part **20** configured to supply water from an external water source (not shown) into the outer tub and a detergent supply part **25** configured to supply detergent to the outer tub **5**. Moreover, the washing machine further includes a water drain passage **30** which is connected to the lower surface of the outer tub **5** so as to guide water inside the outer tub **5** to be drained to the outside. The washing machine include a water drain pump **33** provided on the water drain passage **40** to drain water.

Further, the washing machine includes a circulation passage **40** to guide at least some of air inside the outer tub **5** to flow out of the outer tub **5** and be resupplied to the outer tub **5**. The washing machine includes a fan **50** provided on the circulation passage **40** to move air on the circulation passage **40**. Furthermore, the washing machine includes a temperature and humidity controller (not shown) such as heater **550** or a cooler (not shown) configured to reduce humidity of air on the circulation passage **40** or to increase a temperature of the air.

Moreover, the washing machine includes a suction passage **45** to guide external air of the outer tub **5** or the cabinet **1** to be introduced into the outer tub **5**. The washing machine includes an exhaust passage **48** to guide remaining air of air inside the outer tub **5** except for partial air introduced into the circulation passage **40** to be exhausted.

In addition, the washing machine includes a filer unit **60** provided on the circulation passage **40** to filter foreign

substances included in air. The filer unit **60** includes filter nets **161**, **261**, and **361** disposed on the circulation passage **40** to collect foreign substances included moving air, and filter frames **163**, **263**, and **363** configured to support the filter nets **161**, **261**, and **361**.

Moreover, the washing machine a plurality of nozzles **175**, **275**, and **375** configured to spray cleaning water to partial areas of the filter nets **161**, **261**, and **361**. The washing machine includes a nozzle disposition part **70** spaced apart from the filter nets **161**, **261**, and **361** and in which a plurality of nozzles **175**, **275**, and **375** are arranged. The washing machine includes nozzle water supply hoses **172**, **272**, and **372** connected to the nozzle disposition part **70** to supply cleaning water sprayed from the plurality of nozzles **175**, **275**, and **375**.

Further, the washing machine includes a filter driving unit to control the filer unit **60** and the nozzle disposition part **70** to move relative to one another. Although the plurality of nozzles **175**, **275**, and **375** spray the cleaning water to partial areas of the filter nets **161**, **216**, and **361**, the cleaning water is sprayed to the total area of the filter nets **161**, **216**, and **361** with a time difference due to the relative motion.

Further, the washing machine may include a brush **90** configured to remove foreign substances collected in the filer unit **60**. The brush **90** sweeps surface of the filter nets **161**, **216**, and **361** to drop foreign substances collected in the filter nets **161**, **216**, and **361**. At least some of the foreign substances dropped from the filter nets **161**, **216**, and **361** by the brush **90** adhere to the brush **90**.

The cabinet **1** includes a front panel **2** to form a front surface of the washing machine. The front panel **2** is formed therein with an input port **3** to input or output laundry into or from the inner tub **10**. A door **60** opens/closes the input port **3** and is hinged to the front panel **2** to open/close the input port **3**. Further, the cabinet **1** includes two side panels (not shown) forming left and right surfaces, a top panel (not shown) forming a top surface, a bottom panel (not shown) forming a bottom surface, and a rear panel (not shown) forming a rear surface.

The front panel **2** includes a control panel **4** being a user interface. The control panel **4** is means to allow a user to exchange information with a controller (not shown) of the washing machine.

The control panel **4** includes a power input unit (not shown) configured to allow a user to input a power supply command to the washing machine and an input unit (not shown) configured to allow the user to select a realizable laundry treatment method of a device. The laundry treatment method includes a method for controlling water or air to be supplied into the laundry. The control panel **4** may include a display unit (not shown) configured to display information on a laundry treatment method or an operation process of a washing machine selected by a user.

The outer tub **5** has a cylindrical shape and is fixed inside the cabinet **1** by an outer tub support part **8**. An outer input port (not shown) communicating with the input port **3** is provided at a front surface of the outer tub **5**.

A gasket **9** is provided between the outer tub input port and the input port **3**. The gasket **9** prevents vibration occurring from the outer tub **5** from being transferred to the cabinet **1** and prevents the cleaning water stored inside the outer tub **5** from being leaked. The gasket **9** may be made of an elastic material such as rubber.

The inner tub **10** is rotatably disposed inside the outer tub **5** by a driving unit (not shown) provided at a rear surface of the outer tub **5**. The inner tub **10** is formed therein with an inner tub input port (not shown) communicating with the outer tub input port. The inner tub **10** is formed therein with a plurality of through holes **13** formed through an outer peripheral surface arrange along the outer peripheral surface.

The water supply part **20** includes a water supply passage **23** configured to guide water from an external water source (not shown) to a detergent supply part **25** and a water supply valve **21** configured to open/close the water supply passage **23**. The detergent supply part **25** includes a detergent storing part **26** configured to store a detergent and an outer tub supply pipe **27** configured to guide water containing the detergent from the detergent storing part **26** into the outer tub **5**. The detergent storing part **26** may be provided to be detached from the front panel **2**. Hereinafter, the water supplied into the outer tub **5** through the outer tub supply pipe **27** is defined as wash water.

The water supply part **20** includes nozzle water supply hoses **172**, **272**, and **372** configured to guide water to the nozzle disposition part **70**. In this case, the water supply part **20** may include a nozzle water supply valve (not shown) configured to open/close the nozzle water supply hoses **172**, **272**, and **372**. Each end of the nozzle water supply hoses **172**, **272**, and **372** may be directly connected to the water supply source and may be branched from the water supply passage **23** to be connected to the water supply source. Another end of the nozzle water supply hoses **172**, **272**, and **372** are connected to a water supply connecting part **73** (see FIG. **3**) which is formed at one side of the nozzle disposition part **70**. Hereinafter, water sprayed to the nozzle **175**, **275**, and **375** through the nozzle water supply hoses **172**, **272**, and **372** is defined as cleaning water.

A start end of the water drain passage **30** is connected with a lower side of the outer tub **5**. A water drain hole **31** communicating an inside of the outer tub **5** with the water drain passage **30** at a point connected with the water drain at the lower side of the outer tub **5**.

It is preferred that the drain pump **33** is disposed at a side lower than a level of the clearing water inside the outer tub **5** and is disposed at the lowermost point on the water drain passage **30**. The water drain passage **30** extends from the water supply hole **31** to a water flow introduction port (not shown) of the drain pump **33**, and extends a water flow outflow port (not shown) of the drain pump **33** to an outside of the cabinet **1**.

The water drain passage **30** includes a section upwardly extending to a position higher than a level of wash water inside the outer tub **5**. Accordingly, a water trap is formed due to water drained from the water drain passage **30**.

The circulation passage **40** guides some of air inside the outer tub **5** to flow out of the outer tub **5** and to be resupplied to the outer tub **5**. The circulation passage **40** may be provided at a lower circumferential surface of the outer tub **5**. A start end **41** and a termination end **42** of the circulation passage **40** are connected to the outer tub **5**.

The start end of the circulation passage **40** is connected to a side surface of the outer tub **5**. A "the start end **41** of the circulation passage **40** is connected to a side surface of the outer tub **5**" means to include "the start end is connected between a side surface and a top surface of the outer tub **5**".

The termination end **42** of the circulation passage **40** is connected to a top side of the gasket **9**. That is, a hole is formed through the gasket **9** and the circulation passage **40** is connected to the hole.

A direction from the start end **41** to the termination end **42** on the circulation passage **40** is a flow direction of air inside the circulation passage **40**. An upper side and a lower side are defined based on the flow direction of air. The circulation

passage **40** includes a section **43** which upwardly extends from the upper side to the lower side. The circulation passage **40** may be provided so that a start end of the upwardly extending section **43** becomes a start end of the circulation passage **40**. The circulation passage **40** includes a section **44** which is bent from a termination end of the upwardly extending section **43** in a direction of the gasket **9** and extends in a forward direction.

The fan **40** is provided in the upwardly extending section **43** on the circulation passage **40**. The heater **55** or the cooler (not shown) is provided at a forward extending section **44**.

The suction passage **45** may be directly connected to the outer tub **5**, and may be connected on the circulation passage **40** as in the present embodiment. In the present embodiment, the suction passage **45** guides external air to be introduced into the circulation passage **40**. The heater **55** is provided at the lower side of an suction passage connection end **47** on the circulation passage **40** being a point in which air inside the suction passage **45** is introduced into the circulation passage **40**. Further, the fan **50** is provided at the lower side of a suction passage connection end **47** on the circulation passage **40**. Accordingly, both of air circulated to one heater **43** and sucked air may be heated, and air may be circulated to one a circulation fan **41** and air may be sucked.

An suction port **46** of the suction passage **45** is an opening portion in which external air is introduced in the suction passage **45**. When the suction port **46** is formed inside the cabinet **1**, air present at a space between the cabinet **1** and the outer tub **5** is introduced into the suction passage **45**. When the suction port of the suction passage **45** is formed outside the cabinet **1**, external air of the cabinet **1** is introduced into the suction passage **45**. In the specification, the term 'external air' means include both of the external air of the cabinet **1** and air between the cabinet **1** and the outer tub **5**.

The filer unit **60** is provided a lower side of the suction passage connection end **47** on the circulation passage **40**. The filer unit **60** is provided inside the upwardly extending section **43**, which means to include a case where the filer unit **60** is provided at a termination end of the upwardly extending section **43** being a point between the upwardly extending section **43** and the forward extending section **44**. The filer unit **60** is provided at a lower side of the fan **50** on the circulation passage **40**. The filer unit **60** is provided at an upper side of the heater **55** or the cooler on the circulation passage **40**.

The filter nets **161**, **261**, and **361** are disposed to traverse a section of the circulation passage **40**. The filter nets **161**, **261**, and **361** are disposed to traverse the upwardly extending section **43**, which means to include a case where the filter nets **161**, **261**, and **361** are disposed to traverse a termination end of the upwardly extending section **43** being a point between the upwardly extending section **43** and the forward extending section **44**. The filter nets **161**, **261**, and **361** are laterally disposed to traverse the upwardly extending section **43**. The term 'laterally' means to include a case where the filter nets **161**, **261**, and **361** are inclined toward a horizontal direction.

The nozzle disposition part **70** is disposed at a lower side with respect to the filter nets **161**, **261**, and **361** on the circulation passage **40**. The nozzle disposition part **70** is disposed close to the filter nets **161**, **261**, and **361**. In an embodiment where the filter nets **161**, **261**, and **361** are laterally disposed to traverse the upwardly extending section **43**, the nozzle disposition part **70** is disposed at top sides of the filter nets **161**, **261**, and **361**.

The nozzle disposition part **70** is formed therein with a nozzle water supply passage through which cleaning water passes. A water supply connecting part is formed at a side of the nozzle disposition part **70**, and cleaning water is introduced into the nozzle water supply passage through the water supply connection part.

The plurality of nozzles **175**, **275**, and **375** communicating with the nozzle water supply passage are formed at a surface viewing the filter nets **161**, **261**, and **361** of the nozzle disposition part **70**. The plurality of nozzles **175**, **275**, and **375** spray cleaning water in a direction in which the filter nets **161**, **261**, and **361** are disposed. In an embodiment where the nozzle disposition part **70** is disposed at top sides of the filter nets **161**, **261**, and **361**, the plurality of nozzles **175**, **275**, and **375** are provided at a bottom surface of the nozzle disposition part **70** and spray the cleaning water in a downward direction. The plurality of nozzles **175**, **275**, and **375** are disposed in a direction to traverse a track of the relative motion on a bottom surface of the nozzle disposition part **70**.

The brush **90** makes contact with the filter nets **161**, **261**, and **361** in a direction to traverse the track of the relative motion. The brush **90** is disposed at a lower side with the filter net on the circulation passage **40**. In an embodiment where the filter nets **161**, **261**, and **361** are disposed to laterally traverse the upwardly extending section **43**, the brush **90** is disposed at lower sides of the filter nets **161**, **261**, and **361**. The brush **90** is disposed in a direction where the plurality of nozzles **175**, **275**, and **375** are arranged. That is, the brush **90** makes contact with the filter nets **161**, **261**, and **361** along a collision part of cleaning water sprayed from the plurality of nozzles **175**, **275**, and **375** with the filter nets **161**, **261**, and **361**.

Further, the washing machine includes a brush arm **92** configured to support the brush **90**. The brush **90** is fixed to a brush fixing part **91** along the brush arm **92**.

Further, the washing machine may include a water level sensor (not shown) configured to detect a water level inside the outer tub **5**. Referring to FIG. **4**, the water level sensor may transmit a signal at a maximum level H when laundry inside the inner tub **10** is not sunk under wash water. That is, the water level sensor may transmit a signal at a maximum level H when a level inside the outer tub **5** is less than a lowermost part of the inner tub **10**.

The washing machine may include a controller (not shown) configured to receive a signal transmitted from the water level sensor. When the controller receives the signal, the controller operates a filter driving unit to control cleaning water to be sprayed to the plurality of nozzles **175**, **275**, and **375** while performing the relative motion.

A flow of air and water according the present embodiment will be described with reference to FIG. **3** and FIG. **4** as follows.

A B arrow direction is an air circulation direction of an outer tub **5**. When a fan **50** is operated, some of air from an inside of the outer tub **5** in a positive pressure state is moved to a circulation passage **40** in a negative pressure state through a start end **41** of the circulation passage **40**. The air moved to the circulation passage **40** is mixed with external air at the exhaust passage connecting end **47** point. The mixed air is moved to a termination end **42** of the circulation passage **40** sequentially through the fan **50**, the filer unit **60**, and the heater **43**. The air moved to the termination end **42** of the circulation passage is resupplied into the outer tub **5**.

A C arrow direction is a suction direction of external air. When a circulation fan **41** is operated, external air from an outside of the outer tub **5** or an outside of the cabinet **1** in an

atmospheric pressure state is introduced into a circulation passage **40** in a negative pressure state. The air introduced into the circulation passage **40** is supplied into the outer tub **5** sequentially through the fan **50**, the filer unit **60**, and the heater **43**.

A D arrow direction is an exhaust direction of air. When the fan **50** is operated, the air is exhausted from an inside of the outer tub **5** in a positive pressure state to an outside of the outer tub **5** or the cabinet **1** along an exhaust passage **48**.

An E arrow direction is a water drain direction of water (the wash water and the cleaning water). Water inside the outer tub **5** is introduced into a drain passage **33** through a water drain hole **31**. When the drain pump **33** is operated, water introduced into the water drain passage **33** from the outer tub **5** is drained to an outside of the cabinet **1**.

An F arrow direction is a flow direction of cleaning water sprayed from nozzles **175**, **275**, and **375**. The cleaning water sprayed from the nozzles **175**, **275**, and **375** passes through the filer unit **60**. At least some of the cleaning water passing through the filer unit **60** collides with the brush **90**. Next, the cleaning water is moved to the start end **41** of the circulation passage along the upwardly extending section due to gravity. The cleaning water moved to the start end **41** of the circulation passage is introduced into the outer tub **5**. The cleaning water introduced into the outer tub **5** is moved downward along an inner surface of the outer tub due to gravity or falls to a lower side of the outer tub **5** due to the gravity. An opening portion formed at the start end **41** of the circulation passage is formed outward of a virtual vertical line Y making contact with an outer peripheral surface of the inner tub **10** so that cleaning water introduced and fallen inside the outer tub **5** is not introduced into the inner tub **10** through an inner tub through hole **13**. The cleaning water moved to a lower side of the outer tub **5** is introduced into the water drain passage **33** through a water drain hole **31**. When the drain pump **33** is operated, the cleaning water introduced into the water drain passage **33** from the outer tub **5** is drained to an outside of the cabinet **1** together with wash water. In this case, if the cleaning water is drained at a time less than the level H, cleaning water including foreign substances of filter nets **161**, **261**, and **361** is drained not to be introduced into the inner tub **10** so that laundry inside the inner tub **10** is not polluted due the foreign substances.

The washing machine includes a filter driving unit for controlling the filer unit and the nozzle disposition part to move relative to one another so that the cleaning water is sprayed to the entire area of the filter net. Although the plurality of nozzles **175**, **275**, and **375** spray cleaning water to only partial areas of the filter nets **161**, **261**, and **361** at a certain time point, the filter driving unit controls the filer unit **60** and the nozzle disposition part **70** to move relative to one another to sequentially spray the cleaning water to the total area of the filter nets **161**, **261**, and **361**. Hereinafter, a first embodiment to a third embodiment of the relative motion will be described with reference to FIG. **5** to FIG. **10**.

Referring to FIG. **5**, a first embodiment is a relative motion embodiment where a nozzle disposition part **170** is fixed and a filer unit **160** performs a linear reciprocating motion. A filter frame **163** supports the filter net **161** and laterally performs a linear reciprocating motion in a section of the upwardly extending section **43** of the circulation passage **140**. The filter net **161** is fixed to the filter frame **163** and laterally performs a linear reciprocating motion in a section of the circulating passage **140** along the linear reciprocating motion of the filter frame **163**.

In order to cover the whole section of the circulation passage **140** by the filter net **161** at all-time points while the linear reciprocating motion is performed, a filter net **161** is provided so that the lateral area of the filter net **161** becomes minimum twice of a sectional area of the circulation passage **140**.

A filter frame guide **167** for guiding a lateral linear reciprocating motion of the filter frame **163** is formed at an inner surface of the circulation passage **140**. The filter frame guides **167** are provided at one side and an opposite side of the circulation passage **140** in a direction of the linear reciprocating motion at a point in which the filter frame is arranged, respectively. A depression region where a filter frame **163** is retracted and extended according to the linear reciprocating motion is formed at an inner surface of the circulation passage **140**. The filter frame guide **167** is fixed to the depression region to guide the linear reciprocating motion while supporting the filter frame **163**. The filter frame guide **167** includes a rail (not shown) and the filter frame **163** slides the rail to perform the linear reciprocating motion.

The nozzle disposition part **170** is disposed at a lower side of the filter net **161** on the upwardly extending section **43**. That is, the nozzle disposition part **170** is disposed at a top side of the filter net **161** on the upwardly extending section **43**. The nozzle disposition part **170** extends to a direction parallel to a surface of the filter net **161** among directions vertical to the linear reciprocating motion direction of the filter net **161**.

The plurality of nozzles **175** are arranged in an extending direction of the nozzle disposition part **170** on a bottom surface of the nozzle disposition part **170**. That is, the plurality of nozzles **175** are arranged in a direction to traverse the linear reciprocating motion track of the filter net **161**.

It is preferred that minimum two nozzle disposition parts **170** are disposed at both sides in order to spray cleaning water to all areas of the filter net **161** in 1 cycle of the linear reciprocating motion of the filter net **161**. A first nozzle disposition part **170***a* is provided at one side of a section of the circulation passage **140**, and a second nozzle disposition part **170***b* is provided at another side of a section of the circulation passage **140**. The plurality of nozzles **175** includes one nozzle group **175***a* arranged along the first nozzle disposition part **170***a* on a bottom surface of the first nozzle disposition part **170***a* and another nozzle group **175***b* arranged along the second nozzle disposition part **170***b* on a bottom surface of the second nozzle disposition part **170***b*.

A filter driving unit (not shown) of a first embodiment includes a motor (not shown), a crank shaft (not shown) rotated by the motor, and a connecting rod (not shown) to connect the crank shaft with the filter frame **163**. A rotational motion of the motor is converted into the linear reciprocating motion of the filter frame **163**.

Referring to FIG. **6**, a second embodiment is a relative motion embodiment where the filer unit **260** is fixed and the nozzle disposition part **270** performs the linear reciprocating motion. The filter frame **263** supports the filter net **261** supports the filter net **261** and the filter net **261** is fixed to laterally traverse on a section of the upwardly extending section **43** of the circulation passage **240**. The nozzle disposition part **270** laterally performs the linear reciprocating motion on a section of the circulation passage **140**. That is, the nozzle disposition part **270** performs the linear reciprocating motion on a virtual surface parallel to a surface of the filter net **261**.

The nozzle disposition part **270** is disposed at a lower side of the filter net **261** on the upwardly extending section **43**. That is, the nozzle disposition part **270** is disposed at a top

side of the filter net **261** on the upwardly extending section **43**. The nozzle disposition part **270** extends in a direction parallel to a surface of the filter net **261** among directions vertical to the linear reciprocating motion direction of the nozzle disposition part **270**.

The plurality of nozzles **275** are arranged in an extending direction of the nozzle disposition part **270** on a bottom surface of the nozzle disposition part **270**. The plurality of nozzles **275** is arranged in a direction to traverse the linear reciprocating motion track of the nozzle disposition part **270**.

The circulation passage **240** is formed therein with a nozzle disposition part guide (not shown) to guide a lateral reciprocating motion of the nozzle disposition part **270**. The nozzle disposition part guides are disposed at one end and another end of the nozzle disposition part **270** in the linear reciprocating motion direction of the nozzle disposition part **270**, respectively. A rail (not shown) laterally extending along the reciprocating motion track of the nozzle disposition part **270** is provided at an inner surface of the circulation passage **140**. One end and another end of the nozzle disposition part **270** slide the rail to perform the linear reciprocating motion.

The nozzle water supply hose **272** of the second embodiment is a flexible material. The nozzle water supply hose **272** is connected to a water supply connecting part (not shown) of the nozzle disposition part **270**. The nozzle water supply hose **272** is connected to the nozzle disposition part **270** to repeat a motion which is bent and spread according to the linear reciprocating motion of the nozzle disposition part **270**.

A filter driving unit (not shown) of the second embodiment includes a motor (not shown), a crank shaft (not shown) rotated by the motor, and a connecting rod (not shown) to connect the crank shaft with the nozzle disposition part **270**. A rotational motion of the motor is converted into the linear reciprocating motion of the nozzle disposition part **270**.

Referring to FIG. **7** to FIG. **10**, a third embodiment is a relative motion embodiment where the nozzle disposition part **370** is fixed and the filer unit **360** performs the linear reciprocating motion. FIG. **8** is a perspective view illustrating a filer unit **360** omitting a filter net, a nozzle disposition part **370**, and a filter driving unit **380** according to the third embodiment. FIG. **9** is an elevation view illustrating the filer unit **360**, the nozzle disposition part **370**, and the filter driving unit **380** according to the third embodiment when viewed from the top. FIG. **10** is a sectional view illustrating the filer unit **360** and the nozzle disposition part **370** taken along line A-A' of FIG. **9** by vertically cutting the filer unit **360** and the nozzle disposition part **370**.

The third embodiment may include a filter net **340** having an area smaller than an area of the filter net **161** according to the first embodiment. There is no need to protrude a filter frame guide **367** to a lateral direction of the circulation passage **340** unlike the filter frame guide **167** according to the first embodiment. Although the first embodiment needs minimum two nozzle disposition parts **170**, the third embodiment is sufficient to include one nozzle disposition part **370**. Further, unlike the nozzle water supply hose **272** of the second embodiment, the nozzle water supply hose **372** does not need to repeat a bending and spread motion.

The filter frame **363***a* of the third embodiment includes a ring shaped edge frame **363***a* which extends around a section of the circulation passage **340**. The edge frame **363***a* supports the filter net **363** along the circumference. The edge frame **363***a* may have a ring shape. The edge frame **363***a* supports the filter net **363** and performs a rotational motion on a section of the upwardly extending section of the circulation passage **340**. The filter net **361** is fixed to the edge frame **363***a* and performs a rotational motion on a surface of the filter net **363** according to the rotational motion of the edge frame **363***a*.

A filter frame guide **367** is formed on an inner surface of the circulation passage **340** and guides a rotational motion of the edge frame **363***a* around the edge frame **363***a*. The filter frame guide **367** is formed to have a ring shape around a section of the circulation passage **340**. The filter frame **367** is fixed on an inner surface of the circulation passage **340** and guides the rotational motion while supporting the edge frame **363***a*. The filter frame guide **367** includes a rail (not shown), and the edge frame **363***a* slides the rail to perform the rotational motion.

The filter frame guide **367** includes a lateral guide **367***a* to have a ring shape to make contact with an outer peripheral surface of the edge frame **363***a*. The filter frame guide **363** includes a first rib **367***b* which protrudes in a direction of a rotation axis of the rotational motion from an upper portion of the lateral guide **367***a* and extends around the lateral guide **367***a*. A bottom surface of the first rib **367***b* makes contact with a top surface of the edge frame **363***a* to guide rotation of the edge frame **363***a*. The filter frame guide **367** includes a second rib **367***c* which protrudes in a direction of a rotation axis of the rotational motion from a lower portion of the lateral guide **367***a* and extends around the lateral guide **367***a*. A top surface of the second rib **367***c* makes contact with a bottom surface of the edge frame **363***a* to guide rotation of the edge frame **363***a*.

The nozzle disposition part **370** is disposed at a lower side of the filter net **361** on the upwardly extending section **43**. That is, the nozzle disposition part **370** is disposed at a top side of the filter net **361** on the upwardly extending section **43**. The nozzle disposition part **370** extends to a direction parallel to a surface of the filter net **361** among radial directions of the rotation motion track of the filter net **361**. The nozzle disposition part **370** protrudes to a direction of a rotation axis of the rotation motion from a part of a periphery of the edge frame **363***a*. That is, the nozzle disposition part **370** extends to one radial direction of the edge frame **363***a*.

The nozzle disposition part **370** is formed therein with a nozzle water supply passage **374** through which cleaning water passes. That is, the nozzle disposition part **370** has a structure to surround a nozzle water supply passage **374** being an internal space by an external case. The nozzle disposition part **370** includes a top surface, a bottom surface, and both side surfaces of the nozzle water supply passage **374** extending to a radial direction of the edge frame **363***a*.

The bottom surface of the nozzle disposition part **370** is disposed on the same plane as the first rib **367***b* and the filter guide **367** and the nozzle disposition part **370** are integrally injection-molded. A water supply connecting part **373** connected with the nozzle water supply hose **372** is formed at a radial outer side of the nozzle disposition part **370**. The cleaning water is introduced into the nozzle water supply passage **374** through the water supply connecting part **373**.

A plurality of nozzles **375** communicating with the nozzle water supply passage **374** is formed on a bottom surface of the nozzle disposition part **370**. The plurality of nozzles **375** are arranged in an extending direction of the nozzle disposition part **370**. The plurality of nozzles **375** is arranged in a direction to traverse the rotation motion track. The plurality of nozzles **375** sprays cleaning water in a downward direction in which the filter net **361** is arranged.

In order to spray cleaning water to all areas of the filter net **361** in 1 cycle of the rotation motion of the filter net **361**, the plurality of nozzles **375** include a nozzle group (not shown) configured by nozzles for spraying cleaning water to a minimum 1 radial part of the edge frame **363***a*. Hereinafter, arrangement of the nozzle group will be described in detail.

The edge frame **363***a* includes a driven gear **365** formed around the edge frame **363***a*. The driven gear **365** is configured where a plurality of saw teeth are spaced apart from each other by a predetermined distance to be formed around the edge frame **363***a*.

Although a protrusion direction of the driven gear **365** may be an upward, downward, or outward direction of the edge frame **363***a*, the driven gear **365** according to the present embodiment protrudes in a direction of a rotation axis of the rotation motion from the edge frame **363***a*.

The filter driving unit **380** includes a worm gear **383** (driven gear) disposed at an inward direction of the driven gear **365** and meshing with the driven gear **365**. The filter driving unit **380** includes a motor **381** configured to rotate the worm gear **383**. The rotation motion of the motor **381** is converted into a rotation motion of the edge frame **363***a*.

Since the driven gear **365** protrudes ton an inward direction of the edge frame **363***a* and the worm gear **383** is disposed in an inward direction of the driven gear **365**, the worm gear **383** coheres at the driven gear **365** to apply force to an outward side, it is difficult to modify an edge frame **363***a*.

The filter net **361** is supported by a filter net fixing part **364** which is formed along an inner peripheral surface of the edge frame **363***a*. The filter net fixing part **364** is formed at a lower side of the circulation passage **40** on the inner peripheral surface of the edge frame **363***a*. That is, the filter net fixing part **364** is formed at a lower side on the inner peripheral surface of the edge frame **363***a*. The filter net fixing part **364** protrudes to a direction of the rotation axis from the edge frame **363***a* and has a rib shape extending to a direction of the edge frame **363***a*. A periphery of the filter net **361** is fixed to a protrusion end of the rib shape.

It is preferred that the driven gear **365** and the worm gear **383** are disposed at a lower side of the circulation passage **40** with respect to the filter net **361**. That is, it is preferred the driven gear **365** and the worm gear **383** are disposed at a top side with respect to the filter net **361**. In detail, on the inner peripheral surface of the edge frame **363***a*, a filter net **361** is disposed at a lower side being the upper side, and the driven gear **365** protrudes to a direction of the rotation axis from a top side being the lower side. Accordingly, on the circulation passage **40**, foreign substances included in air are filtered by a filter net **361** of the upper side so that foreign substances may not be caught at the driven gear **365** and the worm gear **383**.

The nozzle disposition part **370** disposed at a direction of a surface on which the driven gear **365** is arranged of directions of both surfaces of the filter net **361**. A nozzle **376** for spraying cleaning water to the driven gear **365** is provided at the nozzle disposition part **370**. The nozzle **376** is formed at a top side of the driven gear **365** on a bottom surface of the nozzle disposition part **370**. The nozzle **376** may be formed at an extension line of a direction in which the plurality of nozzles **375** is arranged. Accordingly, even if foreign substances are collected in the driven gear **365**, the foreign substances collected in the driven gear **365** may be removed by cleaning water sprayed from the nozzles **376**.

The motor **381** includes a rotating motor shaft. The worm gear **383** is coupled with the motor shaft and the driven gear **365** is meshed with the worm gear **383**. If the motor **381** rotates the motor shaft, the worm gear **383** is rotated and then the edge frame **363***a* coupled with the driven gear **365** is rotated on a plane along the filter frame guide **367**. A rotation direction of the edge frame **363***a* may be changed according to a rotation direction of the motor **381**.

It is preferred that a rotation direction of the motor **382** is reversely changed if resistance greater than a predetermined reference occurs upon rotation of the motor. Due to reasons such as a case where foreign substances are inserted between the worm gear **383** and the driven gear **365** or between the edge frame **363***a* and the filter frame guide **367**, great resistance may be generated in rotation of the edge frame **363***a*. In this case, if the motor **381** continuously rotates the edge frame **363***a* in the same direction, the foreign substances are firmly inserted so that the rotation motion of the edge frame **303***a* may stop. In order to prevent the above, if the great resistance is generated, the motor **381** changes the rotation direction in itself and changes the rotation direction of the edge frame **363***a*.

It is preferred that the filter driving unit **380** and the driven gear **365** are provided so that the edge frame **363***a* is rotated at speed in the range of 1 rpm to 6 rpm. The motor **381** is a constant speed motor to rotate a motor shaft at constant speed. The number of saw teeth of the worm gear **383** and the driven gear **365** are controlled with respect to a rotation speed of the motor shaft so that the edge frame **363***a* is rotated at speed of 1 rpm to 6 rpm. If the edge frame **363***a* is rotated at speed of 1 rpm to 6 rpm, the cleaning water may sufficiently shock the filter net **361**.

The brush **90** is disposed at a radial direction of the edge frame **363***a*. The brush **90** makes contact with a lower surface being an upper side of the filter net **361**. The brush **90** is disposed at a direction in which the plurality of nozzles **375** is arranged. That is, the brush **90** makes contact with the filter net **361** along a collision region of the sprayed cleaning water with the filter net **361**. One end of the brush arm **92** is fixed to an inner surface of the circulation passage **40**. The brush arm **92** extends in a direction of the rotation axis from the end thereof. Another end of the brush arm **92** is provided to become a free end. A brush fixing part **91** for fixing a lower portion of the brush **90** is provided at an extension direction of the brush arm **92**.

When the edge frame **363***a* performs the rotation motion, the brush **90** sweeps a bottom surface of the filter net **361**. Foreign substances collected in a lower side surface of the filter net **361** are dropped in a downward direction due to gravity or adhere to the brush **90**. When cleaning water from the plurality of nozzles **375** are sprayed to the brush **90**, foreign substances adhering to the brush **90** may be easily removed. Since the brush **90** makes contact with the filter net **361** along a collision region of the cleaning water sprayed from the plurality of nozzles **361** with the filter net **361**, the sprayed cleaning water may shock the brush **90** to easily remove the adhered foreign substances.

Referring to FIG. **10**, a G arrow direction is a flow direction of cleaning water before the cleaning water is sprayed from the nozzle **375**. The cleaning water introduced into the nozzle water supply passage **374** through the nozzle water supply hose **372**, is sprayed toward the filter net **361** through the nozzle **376** and the plurality of nozzles **375**. The sprayed cleaning water collides with the filter net **361** and the brush **90**. A flow direction F of the cleaning water after spraying is as described above. The edge frame **363***a* is controlled to perform a rotation motion during spraying the cleaning water.

Hereinafter, an arrangement example of the plurality of nozzles **375** will be described with reference to FIG. **11** to

FIG. **13**. FIG. **11** is a rear view illustrating a nozzle disposition part **370** which shows an arrangement example of a plurality of nozzles **375** according to a fifth embodiment. FIG. **12** is a rear view illustrating a nozzle disposition part **370** which shows an arrangement example of a plurality of nozzles **375** according to a sixth embodiment. FIG. **13** is a rear view illustrating a nozzle disposition part **370** which shows an arrangement example of a plurality of nozzles **375** according to a seventh embodiment. FIG. **11** to FIG. **13** shows a point through which a rotation axis of the rotation motion virtually passes as O.

For clarity, distances between nozzles of a first nozzle group **75***a* and the rotation axis O are defined as reference values L, respectively. Since corresponding reference values L by the nozzles configuring the first nozzle group **75***a* are calculated, the reference values L are defined as a plurality of values. Respective reference values L have a difference corresponding to a multiple of a predetermined distance d. FIG. **11** to FIG. **13** show a reference value L corresponding to one nozzle among the reference values L.

The plurality of nozzles **375** includes a first nozzle group **75***a* having nozzles which are spaced apart from each other in one radial direction of the edge frame **363***a* on a rear surface of the nozzle disposition part **370**. The nozzles of the first nozzle group **75***a* are spaced apart from each other by a predetermined distance d on a virtual line formed in a radial direction based on the rotation axis O. If the predetermined distance d is reduced, the cleaning water may collide with a surface of the filter net **361**.

Referring to FIG. **11**, a fifth embodiment is an embodiment where there is no addition nozzle group except for the first nozzle group **75***a*.

Although the filter net **361** performs a rotation motion, it is difficult to directly collide cleaning water with a surface region of the filter net **361** corresponding to a predetermined distance d region between one nozzle and another nozzle of the first nozzle group **75***a*. In order to directly collide the cleaning water with a surface region of the filter net **361** corresponding to the predetermined distance d region, the plurality of nozzles **375** may include an additional nozzle group.

Referring to FIG. **12**, a sixth embodiment is an embodiment where a first nozzle group **75***a* and a second nozzle group **75***b* are arranged and there is no addition nozzle group except for the first nozzle group **75***a* and the second nozzle group **75***b*. The plurality of nozzles **375** includes a second nozzle group **75***b* arranged in another radial direction of the edge frame **363***a* forming an angle a with one radial direction on the nozzle disposition part **370**. The second nozzle group **75***b* includes nozzles arranged at a position distant from the rotation axis O by a distance L+d/2 obtained by summing respective reference values L and half of the predetermined distance d. When the filter net **361** performs a rotation motion to spray the cleaning water, the second nozzle group **75***b* sprays the cleaning water to a surface region of the filter net **361** corresponding to a two halves point of the predetermined distanced of the first nozzle group **75***a*.

In order to enlarge the above concept, the following is described by defining n as a natural number of 3 or more, and a value obtained by dividing the predetermined distance d by n as an equal value d/n. The plurality of nozzles **375** includes a second nozzle group **75***b* to a n-th nozzle group in different radial directions of the edge frame **363***a* forming an angle a with one radial direction of the first nozzle group **75***a* on a bottom surface of the nozzle disposition part **370**. Arrangement directions of the first nozzle group **75***a* to the n-th nozzle group form an angle a with each other. The second nozzle group **75***b* includes nozzles arranged at a position distant from the rotation axis O by a distance L+1*d/n obtained by summing respective reference values L and one multiple of the equal value d/n. The n-th nozzle group includes nozzles arranged at a position distant from the rotation axis O by a distance L+(n−1)*d/n obtained by summing respective reference values L and (n−1) multiple of the equal value d/n.

In detail, when n=3, the plurality of nozzles **375** include a first nozzle group **75***a*, a second nozzle group **75***b*, and a third nozzle group **75***c*. When n=4, a fourth nozzle group (not shown) is additionally arranged and the plurality of nozzles **375** includes a first nozzle group **75***a* to a fourth nozzle group. When n=5, a fifth nozzle group (not shown) is additionally arranged and the plurality of nozzles **375** includes a first nozzle group **75***a* to a fifth nozzle group. By enlarging the concept as described above, the plurality of nozzles **375** includes the first nozzle group **75***a* to an n-th nozzle group. When the filter net **361** performs the rotation motion to spray cleaning water, the second nozzle group **75***b* to the n-th nozzle group spray the cleaning water to a surface region of the filter net **361** corresponding to an n equal division point of a predetermined distance d of the first nozzle group **75***a*.

Referring to FIG. **13**, a seventh embodiment is an embodiment where the first nozzle group **75***a* to the third nozzle group **75***c* are arranged and there is no additional nozzle group. The plurality of nozzles **375** includes the second nozzle group **75***b* to the third nozzle group **75***c* arranged in different radial directions of the edge frame **363***a* forming an angle a with one radial direction of the first nozzle group **75***a* on a bottom surface of the nozzle disposition part **370**. Arrangement directions of the first nozzle group **75***a* to the third nozzle group **75***c* form an angle a with each other. The second nozzle group **75***b* includes nozzles arranged at a position distant from the rotation axis O by a distance L+1*d/3 obtained by summing respective reference values L and one multiple of the equal value d/3. The third nozzle group **75***c* includes nozzles arranged at a position distant from the rotation axis O by a distance L+2*d/n obtained by summing respective reference values L and two multiple of the equal value d/3.

Hereinafter, a method for controlling the washing machine will be described. FIG. **14** is a flowchart illustrating a method for controlling a laundry treatment apparatus according to an embodiment of the present invention.

The control method includes a water supplying step S**1** of supplying wash water into the outer tube **10**. A water supply valve **21** closed at the water supplying step S**1** is open. Water is moved to a detergent supply part **25** from the water source provided outside the cabinet **1** through a water supply passage **23**. The water moved to the detergent supply part **25** is supplied into the outer tub **5** through an outer tub supply pipe **27**.

The water supply step S**1** is performed at an early stage of a wash stroke or a rinse stroke. In a case of the wash stroke, detergent included in the detergent supply part **25** is introduced into the outer tub **5** together with the wash water.

The control method includes a laundry washing step S**2** for washing or rinsing laundry in the inner tub **10** by using the wash water introduced into the outer tub **5** after the water supply step S**1**. In the laundry washing step S**2**, an inner tub **10** is rotated to wash or rinse laundry in the inner tub **10**. The laundry washing step S**2** and the water supply step S**1** may be simultaneously performed. In the laundry washing step

S2, foreign substances separated from the laundry float in the wash water inside the outer tub **5**.

The control method includes a water draining step S3 after the laundry washing step S2. In the water draining step S3, the wash water inside the outer tub **5** is drained through a water drain passage **30**. Simultaneously, in the water draining step S3, the cleaning water is controlled to be drained together with the wash water through the water drain passage while controlling the cleaning water to be sprayed through the plurality of nozzles **175**, **275**, and **375** and be drained through the water drain passage **30**. In the water draining step S3, a water drain pump **33** is controlled to be operated, and the filter driving unit controls the filer unit **60** and the nozzle disposition part **70** to move relative to one another.

In the water draining step S3, the cleaning water is introduced into the nozzle disposition part **70** through nozzle water supply hoses **172**, **272**, and **372**, and the cleaning water is sprayed to the filter nets **161**, **261**, and **361** through a plurality of nozzles **175**, **275**, and **375**. Next, the sprayed cleaning water passes through the filter nets **161**, **261**, and **361** while cleaning the filter nets **161**, **261**, and **361** and/or the brush **90**. The cleaning water containing the foreign substances separated from the filter nets **161**, **261**, and **361** and/or the brush **90** is drained to the outside in the above F arrow direction of FIG. **4** by gravity.

In the water draining step S3, it is previously set that the cleaning water is sprayed through a plurality of nozzles **175**, **275**, and **375** while performing the relative motion, a collision part of the cleaning water with the filter nets **161**, **261**, and **361** is formed in a line to traverse the relative motion track. In this case, it is previously set that the sprayed cleaning water collides with partial areas of the filter nets **161**, **261**, and **361** but the cleaning water is sprayed to the entire area of the filter nets **161**, **261**, and **361** by performing the relative motion of one cycle.

In a case of the third embodiment, in the water draining step, it is previously set that the cleaning water is sprayed while performing the rotation motion for the edge frame **363***a*, and the collision art of the cleaning water with the filter net **361** is formed in a line to traverse a radius of the edge frame **363***a*. In this case, it is previously set that the sprayed cleaning water collides with a partial area of the filter net **361** but the cleaning water is sprayed to the entire area of the filter net **361** by performing the rotation motion of one cycle.

In a case of the third embodiment, the control method includes a dry step S4 of performing the rotation motion for the edge frame **363***a* while circulating air through a circulation passage **40**. The dry step S4 may be performed after the water draining step S3.

In the dry step S4, air is controlled to be circulated through a circulation passage **40** by operating a fan **50**. In the dry step S4, air moving on the circulation passage **40** is heated and dehumidified by operating the temperature and humidity controller. In the dry step S4, the edge frame **363***a* is controlled so that the rotation motion is performed by operating a filter driving unit **380**.

If the edge frame **363***a* is rotated, foreign substances of a top surface of the filter net **361** are separated from a bottom side being the upper side of the filter net **361** by a brush **90** making contact with the filter net **361**. In this case, a significant amount of the foreign substances separated from the filter net **361** are collected in the brush **90**.

It is preferred that the brush **90** makes contact with the filter net **361** along a collision region of the cleaning water with the filter net **361** by spraying the cleaning water to the filter net. In this case, in the water draining step S3, the foreign substances collected in the brush **90** may be controlled to be removed by spraying the cleaning water through a plurality of nozzles **375**.

Hereinafter, a drain start point of the cleaning water is described with reference to FIG. **15**. FIG. **15** is a time axis (t) sequence diagram illustrating a detailed stroke start and end time points of a water drain step S3 shown in FIG. **14**.

In the water draining step S3, as described above, in order to prevent foreign substances separated from the filter nets **161**, **261**, and **361** from being mixed and introduced into the inner tub **5**, spray of the cleaning water may be controlled to start to the plurality of nozzles a time point when the water lever is less than the lowermost region of the inner tub **10**.

In the water draining step S3, a first time point of starting drain of the cleaning water and a second time point of starting spray of the cleaning water are defined. In this case, the second time point is later than the first time point. That is why it takes a predetermined time from a water level inside the outer tub **5** to a water level H of FIG. **4** after the first time point of starting drain of the cleaning water filled inside the outer tub **5**.

Referring to FIG. **15**, in an embodiment, after a drain stroke S31 of wash water is terminated after the first time point, a drain stroke S33 of cleaning water may be controlled to start. In this case, the second time point is a termination time point of the drain S31 stroke of wash water.

Referring to FIG. **15**, in another embodiment, a drain stroke S31 and S32 of cleaning water may be controlled to start when a water level inside the outer tub **5** after the first time point becomes the water level H of FIG. **4**. In this case, the second time point is a time point when a water level inside the outer tub **5** during the drain stroke S31 of the cleaning water becomes the water level of FIG. **4**. In this case, the drain stroke S31 and S32 of cleaning water may be terminated similar to the drain stroke S31 of wash water (S31), and may be terminated (S32) after the drain stroke S31 of wash water is terminated.

That is, a difference between the first time point and the second time point may be preset as a value greater than a predetermined time taken when a water level inside the outer tub **5** after the first time point becomes the lowermost region of the inner tub **10**.

Although embodiments have been described with reference to a number of illustrative embodiments thereof, it should be understood that numerous other modifications and embodiments can be devised by those skilled in the art that will fall within the spirit and scope of the principles of this disclosure.

The invention claimed is:

1. A laundry handling apparatus comprising:
- a cabinet;
- an outer tub disposed inside the cabinet;
- an inner tub rotatably disposed inside the outer tub;
- a circulation passage configured to guide at least some air inside the outer tub to flow out of the outer tub and be resupplied to the outer tub;
- a fan disposed in the circulation passage and configured to move the air;
- a filter unit comprising:
  - a filter net that is disposed in the circulation passage and that is configured to collect foreign substances contained in the moving air, and
  - a filter frame that supports the filter net;
- a brush disposed at a lower side with respect to the filter net and configured to contact the filter net in a direction transverse to a motion track of the filter net;

a plurality of nozzles configured to spray wash water onto the filter net;

a nozzle disposition unit that is disposed at an upper side with respect to the filter net and located in a position spaced apart from the filter net and that has the plurality of nozzles arranged therein;

a nozzle water supply hose that is connected to the nozzle disposition unit and that is configured to supply the wash water to the plurality of nozzles; and

a filter driving unit that allows the filter unit and the nozzle disposition unit to move relative to each other,

wherein the brush is configured to contact a region of the filter net that is sprayed by the wash water through the plurality of nozzles.

2. The laundry handling apparatus of claim **1**, wherein the plurality of nozzles are disposed in a direction transverse to a track of the relative motion.

3. The laundry handling apparatus of claim **1**, wherein the circulation passage comprises a section that upwardly extends from an upper side to a lower side, the upper side and the lower side being defined based on a flow direction of air inside the circulation passage,

the filter net is disposed to laterally traverse the upwardly extending section of the circulation passage,

the nozzle disposition unit is disposed at a top side of the filter net, and

the plurality of nozzles are provided at a bottom surface of the nozzle disposition unit and are configured to spray the wash water.

4. The laundry handling apparatus of claim **1**, wherein the nozzle disposition unit is fixed, and

the filter driving unit is configured to move the filter unit.

5. The laundry handling apparatus of claim **1**,

wherein the nozzle disposition unit is disposed at a lower side with respect to the filter net, and

the brush is disposed at a lower side with respect to the filter net.

6. The laundry handling apparatus of claim **1**, wherein the nozzle disposition unit is disposed at a lower side with respect to the filter net.

7. The laundry handling apparatus of claim **4**, wherein the filter frame comprises an edge frame configured to support the filter net along a periphery of the edge frame, and

the filter driving unit allows the edge frame to perform a rotation motion.

8. The laundry handling apparatus of claim **7**, wherein the nozzle disposition unit protrudes in a direction of a rotation axis of the rotation motion from a part of the periphery of the edge frame, and

the plurality of nozzles comprise a first nozzle group comprising nozzles spaced apart from each other in one radial direction of the edge frame on the nozzle disposition unit.

9. The laundry handling apparatus of claim **8**, wherein the nozzles of the first nozzle group are spaced apart from each other by a predetermined distance (d), and

when distances between the nozzles of the first nozzle group and the rotation axis (O) are defined as reference values (L), respectively,

the plurality of nozzles comprise a second nozzle group comprising nozzles arranged at a position distant from the rotation axis (O) by a distance (L)+(d)/2 obtained by summing respective reference values (L) and half of the predetermined distance (d), in another radial direction of the edge frame forming an angle (a) with one radial direction on the nozzle disposition unit.

10. The laundry handling apparatus of claim **8**, wherein the nozzles of the first nozzle group are spaced apart from each other by a predetermined distance (d), and

when n is defined as a natural number of 3 or more, and a value obtained by dividing the predetermined distance (d) is defined by (n) as an equal value (d/n), and distances between the nozzles of the first nozzle group and the rotation axis (O) are defined as reference values (L), respectively,

the plurality of nozzles comprise a (n)-th nozzle group configured by nozzles arranged at a position distant from the rotation axis (O) by a distance (L)+(n−1)*(d/n) obtained by summing respective reference values (L) and (n−1) multiple of the equal value (d/n), in different radial directions of the edge frame forming an angle (a) with one radial direction on the nozzle disposition unit.

11. The laundry handling apparatus of claim **7**, wherein the edge frame comprises a driven gear formed along the periphery of the edge frame,

the filter driving unit comprises: a worm gear meshing with the driven gear; and a motor configured to rotate the worm gear,

the nozzle disposition unit is disposed at a side of the filter net facing the driven gear, and

the nozzle disposition unit comprises a nozzle configured to spray wash water to the driven gear.

12. The laundry handling apparatus of claim **7**, wherein the edge frame comprises a driven gear protruding in a direction of a rotation axis of the rotation motion along the periphery of the edge frame, and

the filter driving unit comprises: a worm gear meshing with the driven gear; and a motor configured to rotate the worm gear.

13. The laundry handling apparatus of claim **7**, wherein the edge frame comprises a driven gear formed along the periphery of the edge frame,

the filter driving unit comprises: a worm gear meshing with the driven gear; and a motor configured to rotate the worm gear, and

the driven gear and the worm gear are disposed at a lower side with respect to the filter net.

14. The laundry handling apparatus of claim **11**, wherein a rotation direction of the motor is reversely changed if resistance greater than a predetermined reference occurs upon rotation of the motor.

15. The laundry handling apparatus of claim **7**, wherein

the edge frame comprises a driven gear formed along the periphery of the edge frame,

the filter driving unit comprises: a worm gear meshing with the driven gear; and a motor configured to rotate the worm gear, and

the filter driving unit and the driven gear are provided so that the edge frame is rotated at speed in the range of 1 rpm to 6 rpm.

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